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THE ATLANTIC FERRY.

Mr. Frederic Porter

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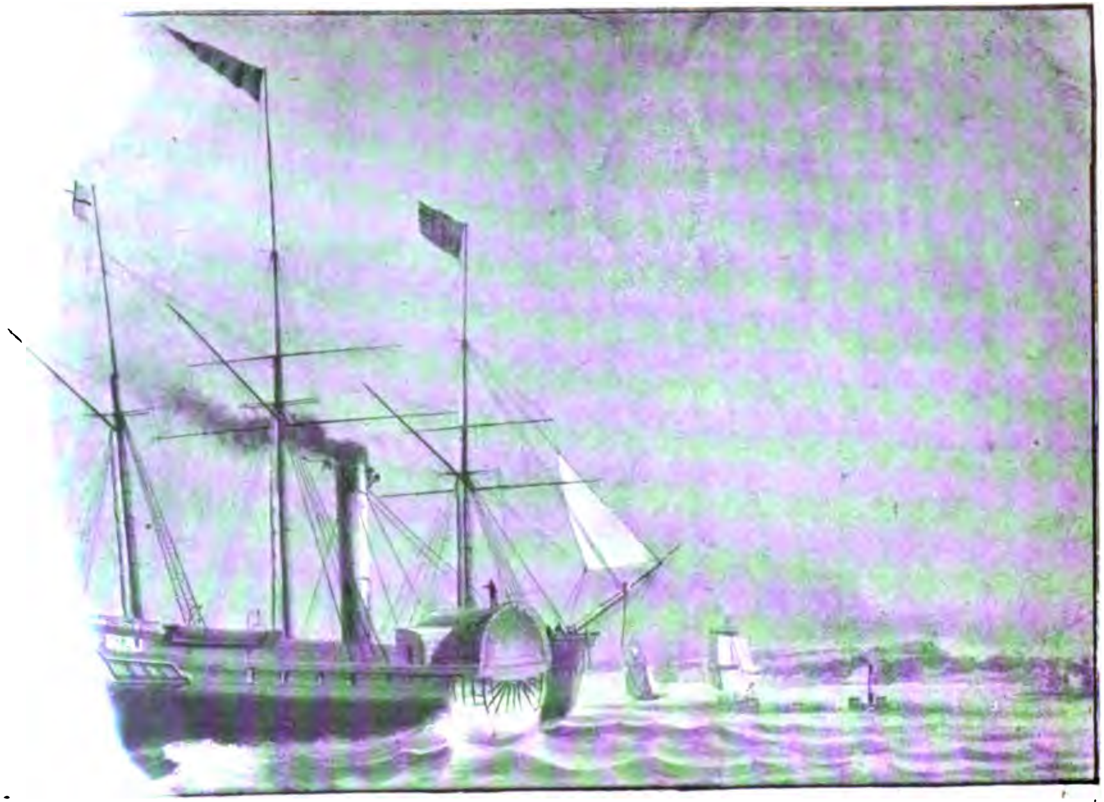

T BRITISH QUEEN (1839). (The "President," 1840, was identical in build.)

Frontispiece, see page 10.

THE ATLANTIC FERRY

ITS SHIPS, MEN, AND WORKING.

BY

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MEMBER OF THE INSTITUTION OF NAVAL ARCHITECTS.

With Numerous Illustrations, Diagrams, and Plans.

FIRST POPULAR EDITION.

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PREFACE.

THE importance and extent of the Transatlantic steam trade has, ever since its commencement, been the occasion of many interesting articles in magazines, newspapers, and scientific periodicals; but, so far as I can trace, no publication has yet been issued which would, in itself, give an ordinary reader or passenger an idea of the routine, forethought, and general arrangements necessary to carry on such a far-reaching organization as a great steamship line, and which would, at the same time, set forth the various efforts of the noted merchants and scientists who have initiated and carried on the service, and also the nature and results of the more remarkable examples of vessels and machinery which they have employed.

It may perhaps be thought that the chapters relating to the working and management are somewhat brief; but in a book of this kind it would not serve any purpose to describe minutely the minor details of the various departments, or duties appertaining to individuals; consequently, only such leading points are described as would serve to show the general system by which the organization is carried on.

The chapters devoted to a description of the inspection made by the Governmental Supervising Authorities will, I trust, be reassuring to those who, for health, pleasure, or business, are constantly travelling by the great Liners, as they fully explain the careful and searching nature of the inspection and survey which is made periodically by an able staff of Surveyors, to insure safety under all circumstances; and as these gentlemen are solely in the service of their respective Governments, they are removed from all liability of being influenced by any personal interest or question of cost to the shipowners, which may be entailed by the due fulfilment of the requirements enacted from time to time.

The retrospect of the trade was, in a brief form, brought forward in a paper entitled "Transatlantic Lines and Steamships," read by me before the Liverpool Engineering Society in 1878, then in its infancy, but now one of the most important associations in the provinces. Owing to the favourable manner in which that paper was received, I have since continued to keep note of all the leading events and records, and from this material I have endeavoured to produce a handy and simple book of reference for the numbers engaged in the Atlantic service, and also for the thousands of passengers who are ever passing to and fro on the great Ferry.

With a view of rendering the work pleasant and agreeable reading, all harrowing descriptions of losses which have occurred have been purposely omitted; mention of some being made in a few cases where brief reference is unavoidable, but the general particulars of the vessels

lost, if required, will be found fully set out in Table No. 7.

The events noted of the earlier periods are almost all gathered from my own scrap-book; those of the later periods have either come directly under my own experience, or are from information kindly given by various firms and gentlemen formerly, and at present, engaged in the trade, to whom I must express my indebtedness.

A. J. M.

CENTRAL BUILDINGS, NORTH STREET,
LIVERPOOL, *March* 1892.

PUBLISHERS' NOTE
TO
FIRST POPULAR EDITION.

THE stir made by the recent rapid passages of the large Transatlantic Steamships, has induced the publishers to issue this popular edition.

A few chapters that appeared in the first complete edition have been omitted, as they are not of a sufficiently interesting character to warrant their insertion in a popular issue. Several illustrations have also been omitted, as they would render the work somewhat cumbrous, and they appeal more to the marine engineer than to the public generally.

The work will be found to be a careful and complete record of the doings of the great Transatlantic Steamship Companies from early days to the present time.

ATLANTIC RECORDS AND EVENTS.

			DATE	PAGE
First steamer	to cross the Atlantic	Savannah	1819	3
,, British steamer	,,	Royal William	1838	5
,, Passenger vessel	,,	Second Royal William	1838	5
,, Cunard Line	,,	Britannia	1840	21
,, Collins Line	,,	Atlantic	1849	37
,, Inman Line	,,	City of Glasgow	1850	41
,, Allan Line	,,	Canadian	1854	56
,, Anchor Line	,,	Tempest	1856	54
,, National Line	,,	Louisiana	1863	57
,, Guion Line	,,	Manhattan	1866	59
,, White Star Line	,,	Oceanic	1871	65
,, American Line	,,	Pennsylvania	1873	86
,, Hamburgh American Line	,,	Borussia	1856	95
,, North German Line	,,	Bremen	1858	97
,, Atlantic screw-steamer	,,	Great Britain	1845	17
,, ,, iron steamer	,,	Great Britain	1845	17
,, ,, iron paddle-steamer	,,	Persia	1856	27
,, ,, twin screw-steamer	,,	Notting Hill	1881	92
,, ,, compound engines	,,	Holland	1869	58
,, ,, compound 3-crank engines	,,	Arizona	1879	61
,, ,, triple expansion engines	,,	Martello	1884	89
,, ,, express twin screw	,,	City of New York	1888	52
,, ,, steel steamer	,,	Buenos Ayrean	1879	33
,, ,, midship saloons	,,	Oceanic	1871	67
,, ,, steamer lost	,,	President	1841	9
,, lit with gas	,,	Adriatic	1872	77
,, lit with electric light	,,	City of Berlin	1879	47
Last wooden vessel built	. . .	Collins Adriatic	1857	38
,, sailing of Collins Line	. . .	Baltic	1858	39
,, side-lever engines	. . .	Cunard Scotia	1862	29
,, paddle-wheel built	. . .	Cunard Scotia	1862	29
Oldest vessel now in Atlantic trade	.	Palestine, built	1855	88

			PAGE
Longest steamer afloat . .	Campania,	620 feet overall	35
,, ,, ever built . .	Great Eastern,	691 feet overall	93
Greatest displacement afloat .	Campania,	21,000 tons	35
,, ,, ever built .	Great Eastern,	32,160 ,,	93
,, indicated horse-power, paddles	Great Eastern,	5000 I. H. P.	93
Greatest indicated horse-power, single screw	Etruria,	14,500 ,,	34
Greatest indicated horse-power, twin screw	Campania,	30,000 ,,	35
Greatest daily consumption, paddles	Scotia,	165 tons	29
Greatest daily consumption, screw	Campania,	430 ,,	35
Greatest average speed per hour, paddles	Scotia,	13½ knots	29
Greatest average speed per hour, single screw	Etruria,	19 ,,	34
Greatest average speed per hour, twin screw	Campania,	22 ,,	35
Greatest distance run in one day	City of Paris,	530 ,,	50

QUEENSTOWN TO NEW YORK.

			d.	h.	m.
First passage, under 9 days,	1864,	Cunard Scotia .	8	13	0
,, ,, 8 ,,	1872,	White Star Adriatic .	7	23	17
,, ,, 7 ,,	1884,	Guion Oregon .	6	9	48
,, ,, 6 ,,	1889,	Inman City of Paris .	5	19	18

NEW YORK TO QUEENSTOWN.

First passage, under 9 days,	1863,	Cunard Scotia .	8	3	0
,, ,, 8 ,,	1869,	Inman City of Brussels .	7	22	3
,, ,, 7 ,,	1882,	Guion Alaska .	6	22	0
,, ,, 6 ,,	1889,	Inman City of Paris .	5	23	38

Fastest passage,	1840,	Cunard Acadia,	Liverpool to	New York	11	4	0
,,	1848,	Cunard Europa	,,	,,	11	3	0
,,	1851,	Collins Baltic	,,	,,	9	18	0
,,	1864,	Cunard Scotia,	Queenstown	,,	8	15	45
,,	1872,	White Star Adriatic	,,	,,	7	23	17
,,	1876,	White Star Britannic	,,	,,	7	13	11
,,	1880,	Guion Arizona	,,	,,	7	10	47
,,	1884,	Guion Oregon	,,	,,	6	9	42
,,	1887,	Cunard Umbria	,,	,,	6	4	42
,,	1889,	Inman City of Paris	,,	,,	5	19	18
,,	1891,	White Star Teutonic	,,	,,	5	16	31
,,	1892,	Inman City of Paris	,,	,,	5	14	24

		d.	h.	m.
Fastest passage,	1841, Cunard **Acadia**, Halifax to Liverpool	9	21	0
,,	1852, Collins **Atlantic**, New York to Liverpool	9	17	15
,,	1856, Cunard **Persia**, New York to Queenstown	9	1	45
,,	1863, Cunard **Scotia** ,, ,,	8	3	0
,,	1869, Inman **City of Brussels** ,, ,,	7	22	3
,,	1875, Inman **City of Berlin** ,, ,,	7	15	28
,,	1876, White Star **Britannic** ,, ,,	7	12	47
,,	1882, Guion **Alaska** ,, ,,	6	22	0
,,	1887, Cunard **Etruria** ,, ,,	6	4	36
,,	1889, Inman **City of Paris** ,, ,,	5	22	50
,,	1891, White Star **Teutonic** ,, ,,	5	21	3
,,	1892, Inman, **City of New York** ,, ,,	5	19	57
,,	1893, Cunard, **Campania** ,, ,,	5	17	27

NOTED STEAMERS.

NOTED STEAMERS—*continued.*

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FUNNELS, FLAGS, AND NIGHT SIGNALS OF THE ATLANTIC FERRY.

LINE.	FUNNELS.	FLAGS.	NIGHT SIGNALS.
American, 1892	Red, white keystone, with red star, black top.	Red swallow-tail, white keystone in centre, with red star.	Red light, Roman candle throwing six red balls, red light.
American, 1893	Black, with white band	White, with blue spread eagle	Blue light forward and aft, red light on bridge.
Anchor	Black	White swallow-tail, red anchor in centre	Red and white lights alternately.
Allan	Red, with white band under black top.	Red, white and blue, with pennant	Three blue lights displayed in form of triangle.
Atlantic Transport	Red, with black top	Blue square, with twenty-five small stars in vertical lines of five each.	Roman candle, throwing green, white, red balls twice over.
Beaver	Black, two white bands, black top.	Beaver on white ground, blue border and pennant.	Three green lights simultaneously, one at each end of bridge and one at stern of vessel.
Bordeaux	White, with black top	White, red border, three red crescents in centre, blue letters, C.B.N.V.	Blue, red and white Coston light.
Bristol City	Black, broad white band, with blue star.	White, with blue star	A Coston pyrotechnic signal showing red and green alternately.
Cunard	Red, with black top, and two black narrow bands.	Red, with yellow lion holding world	Blue light and two Roman candles, each throwing six blue balls.
Collins (extinct)	Black, with red top	Red square, with white diamond.	
Donaldson	Black, with white band	Red, white and blue vertical, with letter D in blue.	
Dominion	Red, white and red band, black top.	Red, with white diamond, and blue ball in centre.	Roman candle throwing six red stars.
Fabre	Black	White, with blue cross.	
Furness	Black	Blue square, with letter F in white	Green light amidships turning to red, followed by a second one immediately.
Great Western	Black, red band, blue and white ball.	Red, blue and white ball in centre	A Coston pyrotechnic signal showing alternately red, white, and blue in order named.
Guion	Black, red band and narrow black top.	Blue, white diamond, black star in centre	Blue lights forward, aft, and on bridge simultaneously.

FUNNELS, FLAGS, AND NIGHT SIGNALS OF THE ATLANTIC FERRY.—*Continued.*

LINE.	FUNNELS.	FLAGS.	NIGHT SIGNALS.
Hamburg-American	Black	White and blue, anchor, shield, and letters H.A.P.A.G.	Three Roman candles at stern of vessel, each showing seven stars as follows—white, red, blue, white, red, blue, white.
Inman, to 1886	Black, white band and black top	Red, with white square, having black diamond.	Blue light forward and aft, and red light on bridge, and rocket.
Inman and International[1]	Black, white band and black top	White swallow-tail, I. & I. in centre in red	Same as Inman.
Johnston	Red, with white and blue band and black top.	Red, with blue diagonal stripes, and letters W. J. & Co.	Blue light forward, white on bridge, and red aft.
Leyland	Buff, and black top	Red flag, square	Three red lights in succession.
National	White, with black top	Red Union Jack, ground white, cross in centre.	Blue light forward and aft, and red light on bridge.
Nav. Gen. Italiana	Black, white and black	Red and white ground, lion and red cross	Red, green, white, red Coston light.
Netherlands	Black, white band, green border	Green, white and green, N. A. S. M. in centre.	Green, white and green lights.
North German Lloyd	Cream	White, blue key and anchor crossed, oakleaf wreath.	Two blue and red Coston lights changing together.
Red Star	Cream, with red star, black top	White, with red star	Three red lights forward, bridge and aft.
State (extinct)	Buff, with red ring under black top	Blue swallow-tail, with red and white stripes at top and bottom, and letter S in centre.	Red light forward, blue amidships, and red aft, simultaneously.
Transatlantique	Red, with black top	White, red ball in corner, and name C.G.T.A.	Blue light forward, white light amidships, red light aft.
Thingvalla	Yellow, white band, blue stars	White, with seven pointed blue stars	White, red, red white Coston light.
Twin Screw Line	Cream, with bell-mouth top	White, with two red screw propellers	Blue, red and blue.
White Star	Cream, black top	Red swallow-tail, with white star	Two green lights simultaneously.
White Cross	Yellow, black top	Red, with white cross	Green, white, green Coston light.
Wilson	Red, with black top	White pennant, with red ball	Two red lights.
Warren	Black	Red flag, square, white diamond in centre	Redlightforward, whiteamidships, and green aft.

[1] Now American Line, 1893.

THE ATLANTIC FERRY.

CHAPTER I.

THE EARLY ATLANTIC STEAMERS.

STRANGE as it may seem to the present generation of travellers, it is nevertheless true, that it is but some fifty years since the sailing clippers had things all their own way upon the Atlantic highway. The Black Ball Line of sailing vessels, founded in New York in 1816, with its vessels the **Pacific, New York, Canada,** and others, boasted an average passage of forty days out to New York, and twenty-three days home to Liverpool; but records are also given in an old English paper called the *Literary Panorama,* dated June 1815, in the author's possession, of a ship named the **Galatea** having sailed from St. John's, Newfoundland, in eleven days to Portsmouth without having made a single tack. Following these are the **Red Jacket,** the **Harvest Queen,** the **Independence** (which, although built so far back as 1834, made a passage to Liverpool in fourteen days), the **Sovereign of the Seas,** and the **Dreadnought,** the latter of which may be termed the last

specimen of the famous American clipper fleet. This vessel, the **Dreadnought**, became very celebrated by having made the passage from New York to Liverpool under fourteen days in 1858, and from New York to Queenstown in nine days seventeen hours. She was long in active service, and was only recently (in 1890) wrecked upon the American coast. Some of these sailing clippers gained great renown in the early days of steam navigation by beating the steamers themselves, notably the clipper **Tornado**, of the Morgan line, which, in 1846, arrived in New York before the Cunard steamer, which sailed at the same time, arrived in Boston.

Before describing the steamships of the Atlantic trade it will not be out of place to relate briefly the early efforts made to apply steam-power to the propulsion of vessels.

The first attempt to propel vessels by steam is claimed by the Spanish to have been made at Barcelona, by a paddle-wheel vessel, under the direction of Blasco de Garey, in 1543. Papin, in France, about 1707; Jonathan Hulls, in England, in 1736; William Henry, in Pennsylvania, United States, also are mentioned in connection with it; but the first steamer worthy of being so called was that of John Fitch, which he placed for hire upon the Delaware, at Philadelphia, in 1787. This primitive craft was propelled by a system of paddles or oars working vertically, and was the forerunner of the palatial vessels now plying on the great rivers of the United States. Some remarkable statements of John Fitch, as showing how far-seeing he was, deserve mention. It is stated that, on writing to a friend for the loan of £50 to finish this boat, he stated—

"This, sir, whether I bring it to perfection or not, will be the mode of crossing the Atlantic, in time, for packets and armed vessels." And on another occasion, when praising his hobby to two visitors, he made use of the following words—

"Well, gentlemen, although I shall not live to see the time, you will, when steamboats will be preferred to all other means of conveyance, especially for passengers." After which, one visitor said to the other, "Poor fellow! what a pity he is crazy!"

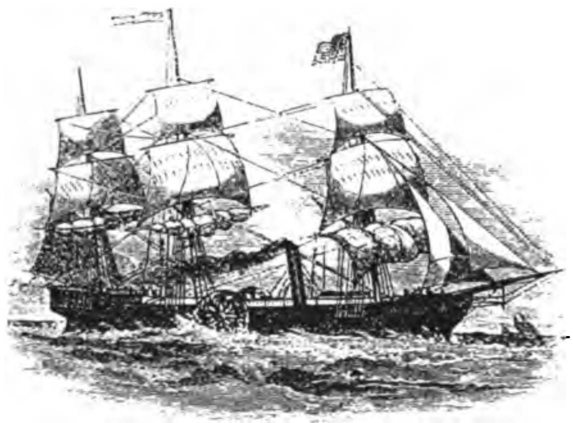
About the same time that Fitch was experimenting with his boat, attempts were also being made in Scotland by Miller, Taylor, and Symington.

After Fitch came, in 1807, Robert Fulton, who first came into notice through his steamer, the **Clermont**, on the Hudson, in 1807. This steamer was soon afterwards, in 1812, followed by Bell's **Comet**, the first on the Clyde, from which date it may be said that steam navigation became fairly launched, as from that time forth steamships began to be built of all kinds and descriptions.

The first actual attempt at Atlantic steam navigation was made by Colonel John Stevens, of New York, in 1819. This far-seeing gentleman despatched what would now be called an auxiliary steamship named the **Savannah**, which was built by Crocker and Fickett, at Corlears Hook, New York, as an ordinary sailing vessel, but was soon afterwards fitted with engines and boilers, and steamed from the city of Savannah on the 25th of May, 1819, arriving in Liverpool, after a passage of twenty-six days, on the 20th of June. Steam-power was used six days, the paddle-wheels

being so designed that they could be unshipped, so as not to interfere with the sailing qualities. This operation required over half-an-hour's time to effect.

Her bunker capacity was but limited, as she could only carry eighty tons of coal, besides a quantity of wood fuel. Notwithstanding her successful trip across the Atlantic, her machinery was afterwards taken out, and she continued



SAVANNAH. 1819. FIRST ATLANTIC STEAMER.

to trade for some years as a sailing vessel, until, like so many other famous vessels, she came to an ignominious end, by being wrecked on Long Island in 1822. The engines of the **Savannah** consisted of an inclined direct-acting cylinder, of 40 inches diameter and 5 feet stroke, and the boiler pressure used was 10 lbs. per square inch. Her speed under steam alone averaged six knots.

The next vessel to cross the Atlantic was a Canadian steamer named the **Royal William**, which was built at

Three Rivers, near Quebec, in 1831, by James Goudie, at a cost of £16,000, and was sold in 1833 to the Spanish Government, who changed the name to the **Ysabel Secunda.** She was the first steam warship which fired a gun in action.

She was 160 feet long, by 44 feet broad, and 17¾ feet deep, of 363 tons burden. The **Royal William** sailed for London from Quebec on August 5th, 1833, and arrived at Gravesend on September 16th following, a passage of over forty days.

In June 1838, another **Royal William** was chartered from the City of Dublin Steam-packet Company, and despatched from Liverpool by the **Transatlantic** Steamship Company to New York. She was built at Liverpool, by Wilson. The engines were made by the firm of Fawcett, Preston and Co., of the same place, and were side-levers of 400 indicated horse-power, having two cylinders 48½ inches diameter and 5½ feet stroke. The paddle-wheels were 24 feet diameter, and her speed was about eight knots an hour. This was the first real passenger steamer to cross the Atlantic, and also the first steamer to sail from Liverpool (on July 5th, 1838). She was also the first to be divided into water-tight compartments by iron bulkheads, of which she had four. When in New York, on the first voyage, she was advertised for the homeward passage in the papers as follows—

"BRITISH STEAMSHIP **Royal William,** 617 tons. Captain Swainson, R.N.R., Commander.

"This fine steamer, having lately arrived, will be despatched again to Liverpool on Saturday, August 4th, at

4 P.M. She is only sixteen months old, and from her peculiar construction (being divided into five sections, each water-tight) she is considered one of the safest boats to England.

"Her accommodations are capacious, and well arranged for comfort. The price of passage is fixed at 140 dols., for which wine and stores of all kinds will be furnished. Letters will be taken at the rate of 25 cents for the single sheet, and in proportion for larger ones, or one dollar per ounce weight. For further particulars apply to Abraham Bell and Co., or Jacob Harvey, 28, Pine Street."

After making a few passages across the Atlantic, she was returned to her owners, in whose possession she remained as a coal hulk until 1888, when she was sold for the sum of £11. Some idea of this vessel's size may be formed from the following table, giving her dimensions as compared with one of the powerful English tugboats of to-day—

Royal William, 145 feet by 27 feet broad, and 17½ feet deep, and 720 tons (400 horse-power).

Tugboat, 1890, 212 feet by 30 feet broad, and 15¼ feet deep, and 712 tons (1000 horse-power).

To take the place of the **Royal William**, the Transatlantic Steamship Company put upon the station the **Liverpool**, a steamer with 10 knots speed.

As an instance of the great attention paid to the earlier Atlantic steamers, the following account of this notable vessel, condensed from the *Liverpool Mercury* of October 12th, 1838, will be of interest—

"The **Liverpool**, it is generally known, was built last year for Sir John Tobin by Messrs. Humble and Milcrest,

and was purchased some months ago by the Liverpool Transatlantic Steam Company, an association branching out of the Dublin Steam Company, to whose enterprise and exertions for years Liverpool, as a port for steam vessels, is mainly indebted for its growing prosperity. Her length is 235 feet from stem to taffrail; her beam 35 feet (exclusive of the breadth of her paddle-boxes); the depth of hold is 21 feet; and she admeasures 1150 tons.

"The engines, built by Messrs. Forrester and Co., Vauxhall Foundry, are well worthy of inspection, both in regard to their compactness and beauty in construction, the extraordinary strength, and their superior finish. They are 468 horse-power. The cylinders are each 75 inches diameter, and the stroke of the piston-rod is 7 feet. The propelling force of these machines (enough to drive the thousands of movements in ten or a dozen of our largest cotton-mills) will be prodigious.

"The iron shaft or spindle that turns the paddle-wheels is equal in girth to a man's body, and but fairly proportioned to the revolutionary force which the cranks will communicate.

"There are two distinct boilers, and two funnels, placed at some distance from each other, and ranging with the masts. The fire-rooms are spacious; the coals are supplied from lateral bunkers, made of plate iron; and large water-taps are at hand in case of danger from fire.

"The 'main or after cabin' is a splendid apartment of 58 feet in length, and 28 feet 9 inches in width at one end, slightly narrowing to 22 feet 4 inches at the stern; it is 8 feet in height to the beams, and 8½ feet between them. . . .

"The state-rooms are exceedingly handsome and commodious. There are in this cabin, sixteen in number, each with two berths or beds, with the exception of two, which are each fitted, for the peculiar accommodation of a party, with three beds. They are well lighted from the roofs and sides by patent lights, those in the sides serving also, on being opened, as ventilators.

"The colouring of these rooms is a warm, delicate pink, with gorgeous damask silk hangings to correspond, of French white, with crimson satin stripes. At the broadest or midship end of this main cabin is the ladies' retiring or private room, where several beds are also elegantly fitted up, and every convenience for the comfort and adornment of 'the fair' is provided. . . .

"There are tanks in abundance, in addition to which water will be daily and hourly distilled by an apparatus fixed for the purpose, and will undergo filtration, so as to be equal in purity and coolness to that of the 'crystal well' of the hermit. It may be added that in the main cabin, including the ladies' state-rooms, and the sofas, no fewer than fifty beds are provided.

"The 'fore cabin' is 45 feet in length, by from 29 feet 4 inches to 23 feet 10 inches in width, and has eight dormitories or state-rooms on each side. This room is fitted in a style somewhat different to the other, but scarcely less beautiful or costly. The walls are empanelled in rosewood and other woods, with rich style, and separated by circular-topped pilasters."

She sailed from Liverpool on the 20th October, 1838, but put back to Queenstown (then called the "Cove of Cork") on the 30th October, sailing thence again on November 6th, and reaching New York on November 23rd. She made several voyages which averaged seventeen days out, and fifteen home; and was then sold to the Peninsular and Oriental Company, who changed her name to the **Great Liverpool**. She was afterwards wrecked off Cape Finisterre, on February 24th, 1846, with a loss of two lives.

It is, however, to the plucky little steamship **Sirius** (178 feet long, by 25½ feet broad, and 18¼ feet deep, of 703 tons) that belongs the real honour of commencing the great Atlantic ferry of to-day. This memorable little

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THE SIRIUS (1838). THE FIRST BRITISH STEAMER TO CROSS THE ATLANTIC.

vessel was built by Menzies, of Leith, and was engined by Messrs. Wingate and Co., of Whiteinch, near Glasgow. The engines were on the side-lever principle, having cylinders 60 inches diameter and stroke of 6 feet, fitted with a surface condenser exactly similar to those now in use. The paddle-wheels were 24 feet diameter, and the steam pressure 15 lbs. A newly-formed company named the British and American Steam Navigation Company (the leading spirit of which was Mr. John Laird, afterwards M.P. for Birkenhead) chartered her from the St. George's Steam-packet Company, and despatched her from Queenstown for New York on April 5th, 1838, under the command of Lieutenant Richard Roberts, R.N., who was afterwards lost in the ill-fated **President**, in 1841. Like the world-famous voyage of the great discoverer, Christopher Columbus, the first voyage of the **Sirius** was one only carried out to its end by the energy and determination of the commander; as shortly after leaving port, owing to continuous head-winds, the crew became mutinous, and declared it was utter madness to proceed in so small a vessel, she being not quite so large as the tugboats of to-day. However, thanks to stern discipline and the persuasive arguments of loaded firearms, the gallant little vessel arrived at New York on April 21st, after an eventful passage of 16½ days, during which she maintained an average speed of 8½ knots per hour on a consumption of about 24 tons of coal per day.[1]

[1] After this voyage she was returned to the owners and employed by them in the Irish Cross Channel Trade until January 1847, when she was wrecked near Queenstown.

A few hours after the arrival of the **Sirius**, another steamer, named the **Great Western**, owned by the Great Western Steam Navigation Company of Bristol, also arrived, having left Bristol on April 8th, 1838, thus making the passage in 13½ days. This "huge vessel," as she was then styled, was built at Bristol, by Patterson, and launched on July 19th, 1837, her dimensions being 212 feet long, by 35¼ feet broad, by 23¼ feet deep, and 1340 tons. She was towed to London to have her engines put on board. The engines were built by Maudslay, Sons, and Field; they were of the side-lever type, having two cylinders 73½ inches diameter, and stroke of 7 feet, indicating 750 horse-power. The paddles were 28¾ feet diameter, and the revolutions about fifteen per minute. Steam was generated in four iron return-flue boilers, carrying 15 lbs. pressure, and the daily consumption was about 33 tons. The average duration of the passages by the **Great Western** between Bristol and New York was 15 days, the fastest being about 13¼ days, and the average speed being about 8½ knots per hour. In 1847 she was sold to the Royal Mail Company for £25,000, and continued in their possession until 1856, when she was broken up.

Another steamer, the **British Queen** (see Frontispiece) was built by Curling and Young, on the Thames, for the British and American Steam Navigation Company, to take the place of the **Sirius**, the engines being supplied by Napier, on the Clyde. Her dimensions were 275 feet long, 37½ feet broad, 27 feet deep, and of 1863 tons. The engines were of the side-lever type, with

THE GREAT WESTERN (1838).

To face page 10.

cylinders $71\frac{1}{2}$ inches diameter, and 7 feet stroke, of 700 horse-power, with surface condenser, driving paddles 30 feet diameter. She sailed from Portsmouth on her first voyage on July 12th, 1839, and, after trading for some time, was sold to the Belgians in 1841. This was owing to the financial collapse of the company, which misfortune was largely brought about by the loss of the **President**, which first sailed from the Mersey on July 17th, 1840, and, after two or three long and unsuccessful voyages, eventually disappeared, after leaving New York on March 11th, 1841, with what would now be called a few passengers. This ill-fated vessel was also built by Messrs. Curling and Young, with engines built by Messrs. Fawcett and Preston, of Liverpool, having cylinders 81 inches diameter and $7\frac{1}{2}$ feet stroke.[1]

By the kind permission of Colonel W. E. Roberts, of Liverpool, nephew of Lieutenant Roberts, a fac-simile of an interesting letter, written by him when in command of the **British Queen**, is appended, and is an interesting souvenir owing to the statement he therein makes that he would not retire until he had command of the first iron vessel to cross the Atlantic; his indignation about the reflection on the speed of his vessel, as compared with the **Great Western**, is also noteworthy, as showing the rivalry existing even then.

[1] Both these vessels, **British Queen** and **President**, had square sterns and one funnel, which was painted white with black top.

Steam Ship British Queen
New York 1 June 1840

My dear Norcott

I just saw a letter from you to [illegible] and felt greatly surprised at having one line as you must have been perfectly aware so large a property as B Queen could not remain idle.. ~~haste~~

I am very glad to find you all well
in health. Mr ——— appears greatly
surprised not getting a letter alone —
he often spends a few hours with James
as I suppose you are aware. He came
out with me and remains till first of
August. I am in great hopes of seeing you
this trip but hope to meet my turn
as I understand you purpose going to
Europe by New York how glad I'll be

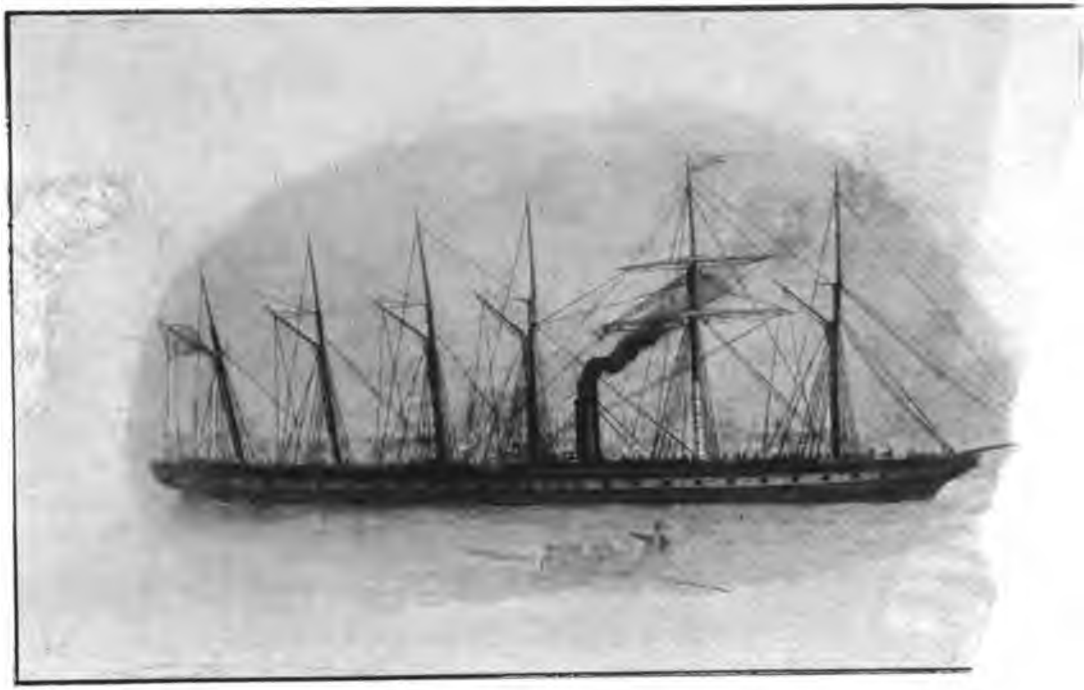
if you will take a passage in the Cobbler Ship, I have the Honour to Commence tho' you think otherwise I can only state there is not a faster Seagoing Steam Vessel in the World and time will tell we have beat Great Western every Voyage this year, and equal last year therefore whoever gave you the idea of our Speed and Powers were perfectly ignorant of them and their Vessels –

Staine
made the Passage from Portsmouth to Newport shorter than ever performed as only 13 d. 11 h. from Pilot to Pilot. let Great Western do that if she can this she has ten hours shorter distance to run -
Sail at 1 PM this day with full Cargo and every berth taken and sincerely do I wish to make a short passage Intend trying for some Shore berth as Jane does not like my going to sea but will not -

beam like Germanic was the first - Iron vessel
to steam across the Atlantic

Sister William ale my ... any thing in
shore better than afloat after 21 years
time the basis ground. ... wrote home
a home also -

Thank my Child
and Anna with fare good by God bless
Ever your
Your Sincere Affection
Brother Robt Roberts



THE GREAT BRITAIN, AS ORIGINALLY RIGGED (1843)

Having now briefly enumerated the earliest vessels which were produced to create the first Transatlantic lines, it will perhaps be convenient to here notice another of the earlier steamships, the venerable **Great Britain**, still extant. This, the first iron steamer of large size, was 274 feet long, 48¼ feet broad, and 31½ feet deep, and of 3270 tons, and was built at Bristol, by Patterson, for the Great Western Steamship Company, fitted with engines made by them from designs by Guppy. There were four diagonal cylinders, each 88 inches diameter, 72 inches stroke, indicating 1500 horse-power, and burning 65 tons per day, working upwards on the crank-shaft, from which motion was brought down to the screw-shaft by means of four endless chains. The propeller was six-bladed, of widely different form from that now in use; the pitch was about 25 feet, and the diameter 15½ feet. Steam at 25 lbs. pressure was generated in three double-ended boilers, fired fore and aft, but without the present system of tubes. Each boiler was 34 feet long, 10 feet wide, and 24 feet high, and had eight furnaces, each 7 feet 6 inches long, by 1 foot 11 inches wide. These engines were, however, found to be very defective, and were replaced after a short time. The career of this wonderful craft has been a varied and chequered one. Launched on July 19th, 1843, she was detained for nearly a year in the dock on account of her beam being too great to allow her to pass out through the dock gates. On July 26th, 1845, she sailed on her first voyage from Liverpool for New York, and continued on that station until September 1846, when she was stranded on Rathmullin Point, County Down, Ireland,

where she remained intact for a whole winter, thus early proving the great strength of iron vessels. In 1853 she was entirely refitted with new masts and engines, and placed upon the Liverpool and Australian trade, in which she was fairly successful until 1874, when she was withdrawn. In 1882 she again underwent a complete change, being altered to a full-rigged sailing vessel, as which she only ploughed the waters of the sea for a brief period, having put into the Falkland Islands leaking, and having been condemned, has remained there ever since as a hulk.

In concluding this early history it only remains to just notice the oft-quoted saying of Dr. Lardner,[1] and we come to the foundation of the great regular lines which to-day bridge the wild and tempestuous Atlantic with swift, silent messengers of peace and plenty.

[1] This noted saying has been constantly referred to, owing to its showing in a remarkable manner the great strides made in steam navigation. It was only in the year 1838 that, at a scientific meeting held in the Royal Institution, Liverpool, Dr. Lardner, a leading scientist of that day, after giving some statistics which he thought proved the difficulty to be insurmountable, stated "that, as to the project which was announced in the newspapers of making the voyage directly from New York to Liverpool, it was, he had no hesitation in saying, perfectly chimerical, and they might as well talk of making a voyage from New York to the moon."

CHAPTER II.

THE CUNARD AND COLLINS LINES.

THE foundation of the modern Transatlantic lines—which should rank as one of the great stepping-stones of an exceptionally eventful age—had but a modest origin. It was conceived by a gentleman bearing a name now well known and honoured wherever a steamship floats, namely, Mr. Samuel (afterwards Sir Samuel) Cunard. This famous gentleman, whose likeness is to be found on a later page, was of Canadian birth and origin. Early perceiving the advantages possessed by steamers over sailing vessels for regularity, Mr. Cunard came to England in 1839, and together with two of the ablest shipping men then existing in Great Britain, Mr. George Burns, of Glasgow, and Mr. David MacIver, of Liverpool, entered into an agreement with the British Government (owing to the earlier vessels already noted being withdrawn) to commence a monthly Transatlantic mail steamship service, from Liverpool to Halifax and Boston, for an annual subsidy of £60,000 per annum. To carry on this trade four steamers, the **Britannia** (launched February 5th, 1840), **Acadia**, **Columbia**, and **Caledonia**, were built of wood by Robert Duncan and Co., and others, at Port Glasgow, each being

230 feet long, by 34½ feet broad, and 22½ feet deep, and of 1150 tons. The engines were of the side-lever type, having two cylinders, each 72½ inches diameter and 82 inches stroke, working up to about 740 indicated horse-power, and driving-paddles 28½ feet diameter, which gave an average speed of 9 knots per hour. The boilers were of the return-flue type, four in number, with twelve furnaces working at 12 lbs. pressure, and having a consumption of about 38 tons per twenty-four hours. The whole of the machinery was made and fitted by Mr. Robert Napier, a name destined afterwards to become famous in the maritime engineering world. The commencement of this line was announced by the following advertisement in the *Liverpool Mercury*, July 3rd, 1840—

"British and North American Royal Mail Steamships of 1200 tons and 440 horse-power each.

1840

"Appointed by the Admiralty to sail for Boston, calling at Halifax to land passengers and her Majesty's mails:

Britannia, Captain Woodruff.
Acadia, Captain Edward C. Miller.
Caledonia, Captain Richard Cleland.
Columbia.

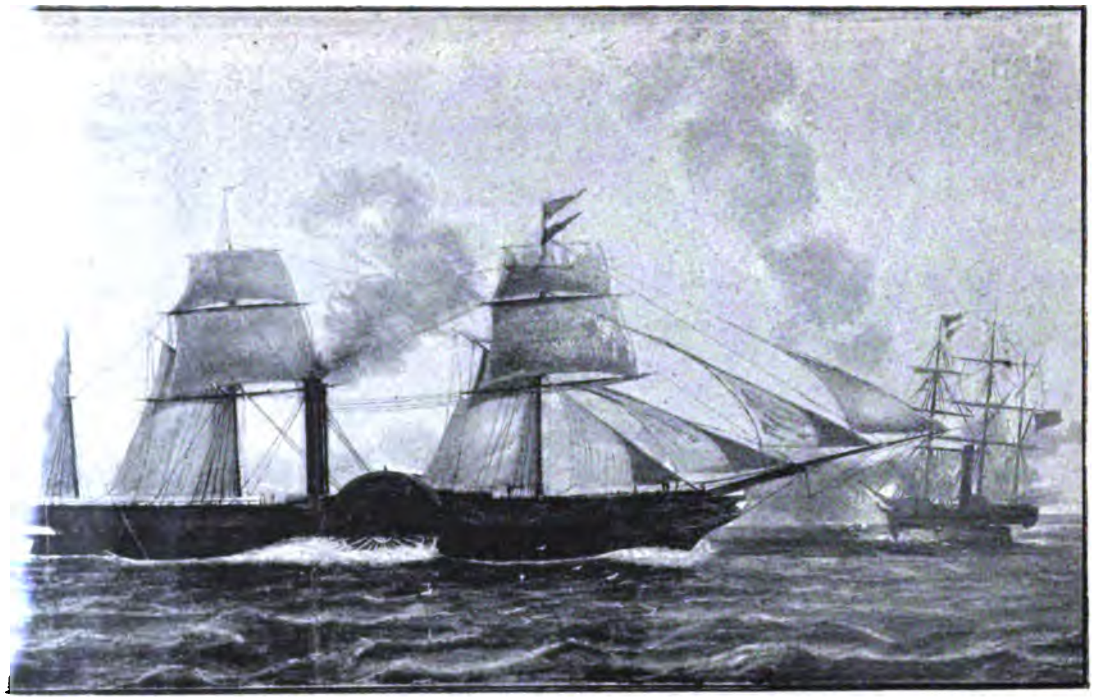
"The **Britannia** will sail from Liverpool on the 4th July; the **Acadia** on the 4th August.

"Passage, including provisions and wine, to Halifax, 34 guineas; to Boston, 38 guineas. Steward's fee, 1 guinea.

"The steamship **Unicorn** plies between Pictou and Quebec, in connection with the above vessels, carrying the mails and passengers.

"For passage, apply to G. and J. Burns, Glasgow; J. B. Foord, 52, Old Broad Street, London; or in Liverpool to D. and C. MacIver, 12, Water Street.

"The **Britannia** goes out of the Coburg Dock this

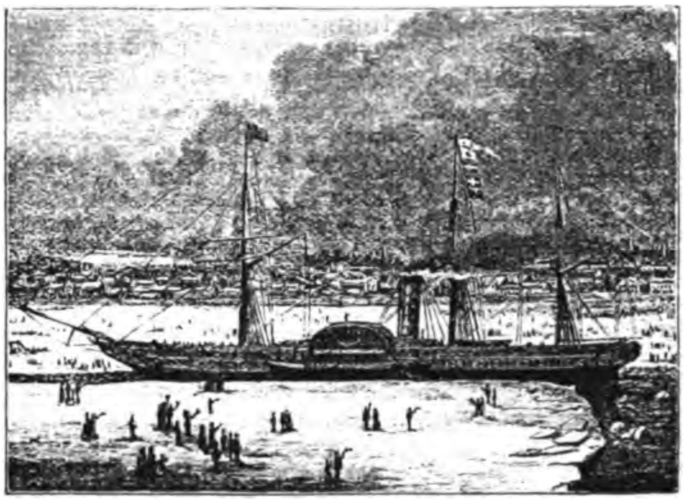


To face page 20.

THE BRITANNIA (1840). FIRST STEAMER OF THE CUNARD LINE.

morning (Friday), the 3rd inst., and all heavy luggage should be sent on board before that time. To-morrow (Saturday morning) at ten o'clock, a steamer will be at the Egremont Slip, south end of Prince's Dock, to take off the passengers."

The great importance of these early mail steamers is clearly shown by the successful attempts made by the people of Boston to release her from the ice, which is



BRITANNIA IN ICE AT BOSTON, 1844.

described in the following extract from the *Liverpool Albion.* The illustration is taken from an old print issued by the people of Boston to commemorate the event.

"*Release of the* **Britannia** *from the Ice at Boston.*—Looking into the windows of a print-shop, I saw an engraving

of our good ship the **Britannia**, which we had just quitted, represented as in the act of forcing her way through the ice of Boston harbour in the winter of 1844, a truly Arctic scene. A fellow-passenger, a merchant from New York, where they are jealous of the monopoly hitherto enjoyed by their New England rival, of a direct and regular steam communication with Europe, remarked to me that, if the people of Boston had been wise, they would never have encouraged the publication of this print, as it was a clear proof that the British Government should rather have selected New York, where the sea never freezes, as the fittest port for the mail-packets. I had heard much during the voyage of this strange adventure of the **Britannia** in the ice. Last winter it appears there had been a frost of unusual intensity, such as had not been known for more than half a century, which caused the sea to be frozen over in the harbour of Boston, although the water is as salt there as in mid-ocean. Moreover, the tide runs there at the rate of four or five miles an hour, rising twelve feet, and causing the whole body of the ice to be uplifted and let down again to that amount twice every twenty-four hours. Notwithstanding this movement, the surface remained even and unbroken, except along the shore, where it cracked. Had the continuance of this frost been anticipated, it would have been easy to keep open a passage; but on February 1st, when the **Britannia** was appointed to sail, it was found that the ice was 7 feet thick in the wharf, and 2 feet thick for a distance of seven miles out; so that waggons and carts were conveying cotton and other freights from the shore to the edge of the ice, where ships were taking in their cargoes. No sooner was it understood that the mail was imprisoned, than the public spirit of the whole city was roused, and a large sum of money instantly subscribed for cutting a canal, seven miles long and 100 feet wide, through the ice. They began the operation by making two straight furrows, 7 inches deep, with an ice-plough drawn by horse, and then sawed the ice into sheets, each 100 feet square. When

these were detached, they were made to slide, by means of iron hooks and ropes fixed to them, under the great body of the ice, one edge being first depressed, and the ropes being pulled by a team of horses, and occasionally by a body of fifty men. On February 3rd, only two days after her time, the steamer sailed out, breaking through a newly-formed sheet of ice, 2 inches thick, her bows being fortified with iron to protect her copper sheathing. She burst through the ice at the rate of seven miles an hour without much damage to her paddles; but before she was in clear water all her guard of iron had been torn off. An eye-witness to the scene told me that tents had been pitched on the ice, then covered by a slight fall of snow, and a concourse of people followed and cheered for the first mile, some in sleighs, others in sailing-boats fitted up with long blades of iron, like skates, by means of which they are urged rapidly along by their sails, not only before the wind, but even with a side wind, tacking and beating to windward as if they were in the water. The **Britannia,** released from her bonds, reached Liverpool in fifteen days, so that no alarm had been occasioned by the delay; and when the British Post Office department offered to defray the expense of the ice-channel, the citizens of Boston declined to be re-imbursed."—LYELL'S *Second Visit to the United States.*

The following notices from the *Liverpool Albion,* Feb. 18th, 1850, will also serve to show the great interest taken in the Cunard vessels, and also the duration of passages then prevailing—

"*The Halifax Steam Squadron.*—As the British and North American Royal Mail Company's magnificent fleet stands pre-eminent among ocean steamers, the following tabular statements of their performances for the past year (1849) will be found interesting. The first shows the time taken by each vessel on her *homeward* passage, including the deviation to, and detention at, Halifax—

Names.	Port.	Sailed.		Arrived.		Time. Days.	Hours.
Europa . .	New York	Jan.	10	Jan.	22	11	18
America . .	Boston	,,	24	Feb.	4	11	3
Canada . .	New York	Feb.	7	,,	19	12	4
Niagara . .	Boston	,,	21	March	6	13	0
Europa . .	New York	March	7	,,	20	12	16
America . .	Boston	,,	21	April	3	12	7
Canada . .	New York	April	4	,,	19	14	12
Niagara . .	Boston	,,	18	,,	30	11	12
Europa . .	New York	May	2	May	14	12	3
Cambria . .	Boston	,,	9	,,	24	12	7
America . .	New York	,,	16	,,	28	11	12
Hibernia . .	Boston	,,	23	June	4	12	6
Canada . .	New York	,,	30	,,	12	12	10
Caledonia . .	Boston	June	6	,,	18	11	19
Niagara . .	New York	,,	13	,,	25	11	9
Europa . .	Boston	,,	20	July	1	10	14
Cambria . .	New York	,,	27	,,	10	13	0
America . .	Boston	July	4	,,	15	11	0
Hibernia . .	New York	,,	11	,,	24	12	10
Canada . .	Boston	,,	18	,,	28	9	22
Niagara . .	New York	,,	25	Aug.	6	12	4
Caledonia . .	Boston	Aug.	1	,,	14	12	18
Europa . .	New York	,,	8	,,	20	11	17
Cambria . .	Boston	,,	15	,,	26	11	2
America . .	New York	,,	22	Sept.	3	11	10
Hibernia[1] . .	Boston	,,	29	—		—	—
Canada . .	New York	Sept.	5	Sept.	17	12	0
Caledonia . .	Boston	,,	12	,,	25	12	18
Niagara . .	New York	,,	19	Oct.	2	13	6
Europa . .	Boston	,,	26	,,	7	10	8
Hibernia[2] . .	New York	,,	29	,,	13	14	0
Cambria . .	New York	Oct.	3	,,	18	14	11
America . .	Boston	,,	10	,,	21	11	6
Canada . .	New York	,,	17	,,	28	11	0
Caledonia . .	Boston	,,	24	Nov.	6	12	9
Niagara[3] . .	New York	,,	31	,,	13	12	17
Europa . .	Boston	Nov.	7	,,	18	11	12
Hibernia . .	New York	,,	14	,,	28	13	16
Cambria . .	Boston	,,	21	Dec.	3	11	14
America . .	New York	,,	28	,,	12	13	16
Caledonia . .	Boston	Dec.	5	,,	19	12	18
Canada . .	New York	,,	12	,,	24	11	22
Europa . .	Boston	,,	19	,,	30	11	3
Hibernia . .	New York	,,	26	Jan.	8	13	8

[1] Struck off Halifax and returned to New York.

[2] Did not call at Halifax.

[3] Had only one engine working.

"We extract from a New York contemporary the following table of the *outward* voyages of British mail steamships during the past year—

"'Annexed is a table, exhibiting the date of arrival, length of passage, number of passengers, with the day of departure, etc., of each steamer between New York and Liverpool during the past year; also one showing the time of arrival, passengers, etc., at Boston during the same period—

Names.	Arrival.		Passage.	Passengers from Liverpool.	Passengers from Halifax.	Day of Departure.		Passengers to Liverpool.	Passengers to Halifax.
Canada .	Jan.	29	16	50	7	Feb.	7	38	10
Europa .	Feb.	21	13¾	86	—	Mar.	7	71	3
Canada .	Mar.	25	14½	88	20	April	4	138	5
Europa .	April	19	12¼	82	7	May	2	129	—
America .	May	5	14¼	71	4	,,	16	118	11
Canada .	,,	17	11½	71	3	,,	31	139	6
Niagara .	June	2	13½	65	5	June	13	115	11
Cambria .	,,	15	13¼	61	3	,,	27	94	—
Hibernia .	,,	29	13¼	95	2	July	11	63	10
Niagara .	July	14	14	83	—	,,	25	92	12
Europa .	,,	27	12¾	123	—	Aug.	8	87	6
America .	Aug.	9	12	92	8	,,	22	94	3
Canada .	,,	25	13½	125	3	Sept.	5	84	7
Niagara .	Sept.	7	13	127	8	,,	19	48	—
Cambria .	,,	22	13¾	71	11	Oct.	3	51	5
Canada .	Oct.	4	12	72	1	,,	17	72	4
Niagara .	,,	19	13¼	148	—	,,	31	14	5
Hibernia .	Nov.	5	16	85	6	Nov.	14	48	9
America .	,,	18	14	84	3	,,	28	76	3
Canada .	Dec.	1	13½	46	13	Dec.	12	78	2
Hibernia .	,,	18	17	69	6	,,	26	36	5

"'The average passages to this port from Liverpool were made in 13 days and 16 hours.

"'The table given on page 26 exhibits the time of arrival, etc., at Boston.

"'The average passage to Boston from Liverpool is 12 days and 22 hours.

"'The **Canada** made the shortest passage to this port,

Names.	Arrival.		Passage.	Passengers from Liverpool.	Passengers from Halifax.	Day of Departure.		Passengers to Liverpool.	Passengers to Halifax.
America .	Jan.	12	13	53	7	Jan.	24	49	2
Niagara .	Feb.	11	15	50	7	Feb.	21	54	8
America .	Mar.	9	13	80	17	Mar.	21	88	14
Niagara .	April	7	14	43	24	April	18	110	11
Cambria .	,,	27	13	41	10	May	9	77	12
Hibernia .	May	12	$13\frac{1}{2}$	52	12	,,	23	35	3
Caledonia .	,,	26	$13\frac{1}{2}$	38	6	June	6	44	5
Europa .	June	7	$11\frac{1}{2}$	53	—	,,	20	105	7
America .	,,	21	$10\frac{2}{3}$	57	8	July	4	83	5
Canada .	July	4	$11\frac{1}{4}$	84	10	,,	18	126	12
Caledonia .	,,	20	$13\frac{3}{4}$	45	—	Aug.	1	38	9
Cambria .	Aug.	3	13	57	6	,,	15	28	4
Hibernia [1] .	,,	16	$11\frac{1}{2}$	68	4	,,	29	26	19
Caledonia .	,,	31	13	65	18	Sept.	12	18	4
Europa .	Sept.	12	$10\frac{2}{3}$	114	18	,,	26	50	8
America .	,,	27	$11\frac{3}{4}$	83	6	Oct.	10	84	10
Caledonia .	Oct.	12	$12\frac{1}{2}$	83	13	,,	24	17	16
Europa .	,,	25	$12\frac{1}{2}$	123	15	Nov.	7	76	7
Cambria .	Nov.	10	$13\frac{3}{4}$	86	5	,,	21	38	3
Caledonia .	,,	24	$14\frac{1}{2}$	14	6	Dec.	5	20	5
Europa .	Dec.	9	$14\frac{3}{4}$	52	4	,,	19	16	7
Cambria .	,,	29	$14\frac{1}{2}$	82	—	Jan.	9	—	—

and the **Hibernia** the longest. The **America** and **Europa** made the shortest to Boston, and the **Niagara** the longest.' "

The actual commencement of this now justly-famed line took place on July 4th, 1840, when the **Britannia** first sailed from the Mersey for Halifax and Boston, carrying the British mail, and arrived at the latter port on the 19th, having made the passage in 14 days 8 hours, including a stop of several hours at Halifax. Since this event to the present time the regular sailings of the steamers of this

[1] The **Hibernia** on this trip sprung a leak, and returned to Halifax and left her passengers and mails; then came to New York for repairs, and sailed on the 29th September for Liverpool direct, with nineteen passengers.

line have been kept up without interruption, though special efforts have sometimes been required. As the gradual expansion of the trade took place other steamers were built and put upon the station; namely, in 1844 the **Cambria** and **Hibernia** of 1040 horse-power, 1422 tons and 9¼ knots, were added; in 1848 the **America**, **Niagara**, **Canada**, and **Europa** of 1820 tons, 1200 indicated horse-power, and 10¼ knots; in 1850 the **Asia** and **Africa**, of 2227 tons, and 2000 indicated horse-power, and steaming 11½ knots per hour. In this same year, the three original vessels were sold, excepting the **Columbia**, which had been wrecked in 1844. Following after these came the **Arabia** in 1852, which was the last wooden vessel built for the Cunard fleet; she was 285 feet long, 40·8 broad by 27·7 deep, and of 2393 tons, the indicated horse-power was 2900, and speed 12 knots.

Each of these succeeding vessels was built of improved design, as experience pointed out, but with no radical departures from the **Britannia** until the year 1856, when the **Persia**, the first iron steamer owned by this line, was put upon the station to maintain the supremacy which was now being contested by other lines.

Another extract is worth printing as showing the financial working of steam shipping forty years ago—

"*The British and North American Royal Mail Company.*—The following particulars respecting the Cunard steam fleet will be found interesting, as showing how the company maintained the service in 1850:—**Arabia**, building, 950 horse-power and 2500 tons (lately sold to the West India Royal Mail Company); **Persia**, building, 950 horse-power

and 2500 tons; **Asia**, 800 horse-power and 2226 tons; **Africa**, 800 horse-power and 2226 tons; **America**, 650 horse-power and 1826 tons; **Canada**, 650 horse-power and 1831 tons; **Europa**, 650 horse-power and 1834 tons; **Niagara**, 650 horse-power and 1824 tons; **Cambria**, 1423 tons. But, besides these, there are some subsidiary lines which require to be mentioned. Thus, there are two steamers, the **Admiral**, of 929 tons and 388 horse-power, and the **Commodore**, of 800 tons and 350 horse-power, which maintain a communication between Liverpool and Havre; and two vessels, the **Camilla**, of 529 tons and 220 horse-power, and the **Lyra**, 543 tons and 275 horse-power, which maintain a communication between Liverpool and Glasgow. The **Margaret**, also, a vessel of 700 tons and 310 horse-power, and the **Laurel**, a vessel of 428 tons and 180 horse-power, are sometimes employed upon these subsidiary lines, though, commonly, the **Margaret** plies between Liverpool and the Mediterranean, and the **Laurel** plies between Belfast and Glasgow. Thus this great enterprise was (1851) maintained by a fleet of steamers, the power of which is 6100 horse for the main line, and 1723 horse for the feeding and subsidiary lines. The subsidy which the enterprise receives from the British Government is, therefore, at the rate of nearly £24 per annum per horse-power upon the whole fleet, feeders and subsidiary lines inclusive. No official or authorized statement has been published of the financial condition of the Cunard Company. Its proprietors are limited in number, and generally to large capitalists, who arrange their interests in private meetings, the results of which are not made public. To estimate the amount of the capital, let the value of the ships be taken, in round numbers, at £120 per horse-power. Thus, for 7823 horse-power, we should have a capital of £936,760. To this must be added the furniture, plate, etc., of the ships, the offices, warehouses, stations, etc., at the several ports with which they communicate, the capital engrossed by which, added to the amount just stated, will make a total which cannot fall short of

To face page 29.

CUNARD STEAMSHIPS PERSIA (1856) AND SCOTIA (1862), THE LAST PADDLE-WHEEL ATLANTIC STEAMER.

£1,500,000. It follows, therefore, that this company, after having defrayed its current expenses, must have a balance of about £375,000 before it can begin to enjoy any net profit; for it has resulted from the general experience of England, both by Government and commercial companies, that besides the current expenses of working a line of steamers, it is necessary to carry yearly to the account of the capital, to cover interest, sinking fund, insurance, etc., a sum equal to 25 per cent. of the total capital involved."—*Liverpool Albion*, February 2, 1852.

Owing to the fact of her being constructed of iron, and having made the fastest passages (see Table 2), the **Persia** became one of the most famous vessels ever existing on the Ferry; she was 360 feet long, by 45·3 feet broad, and 29·9 feet deep, of 3300 tons, the speed being 12½ knots per hour. Both ship and engines were constructed by Messrs. Robert Napier and Sons, Glasgow, the latter being of the "side-lever" type, with two cylinders each 100½ inches diameter and 10 feet stroke, and indicated 3600 horse-power.

The paddle-wheels were 40 feet diameter; the boilers were eight in number, having forty furnaces, the steam-pressure carried being 20 lbs., and the consumption of coal reached 150 tons per day.

The last paddle-vessel, the **Scotia**, which was also built of iron, and engined by Messrs. R. Napier and Sons, came out in 1862, and was 379 feet long, 47·8 feet broad, and 30·5 feet deep, of 3871 tons, and speed of 13½ knots, the engines being of the same type, with cylinders 100 inches diameter and 12 feet stroke, indicating 4000 horse-power on a daily consumption of 165 tons.

No efforts were spared to render these the crack boats

in the service, and with very satisfactory results, as the rates of passage-money were raised for these boats, and a sort of express service for passengers was now practically first introduced across the Atlantic.

Owing to the superiority of the screw-propeller being by this time admitted, these two noble vessels proved to be the last of the ocean-going paddle-wheel type, and were sold; the **Persia** in 1868 to be converted into a sailing-ship, and the **Scotia**, which sailed from Liverpool on her last voyage in September 1875, to the Telegraph Construction and Maintenance Company, who converted her into a twin-screw steamer for telegraph cable purposes, as which she still exists.

Concerning the invention of the screw-propeller, this, like most other matters connected with early engineering, is much disputed, the credit being claimed for Mr. Edward Shorter, of Southwark, who is reported to have taken out a patent for it, and tried it in 1802 on H.M.S. **Doncaster**, working it by means of an ordinary capstan with gearing; other names mentioned as the inventors are Robert Hooke, David Bushnell, and Frederic Sauvage, a Frenchman; but to Mr. F. P. Smith must be given the credit of first having made it successful. Having obtained his patent in 1836, he had it tried on a small vessel named the **Archimedes**, which was built by Henry Wimshurst, who also claims to have had a share in working out the screw-propeller. This little vessel was first tried on the Thames in 1839, and obtained a speed of 8½ miles. Afterwards it was improved upon by Mr. Bennet Woodcroft and Mr. Robert Griffiths, the latter being the introducer of the form now in general use.

The first "screw" steamer brought out by the Cunard Company for their Transatlantic service was the **China**, which was put on the station in 1862, her dimensions being 326 feet long, by 40½ broad, and 27½ deep. She was built by Messrs. Napier and Sons at Glasgow, as were the engines, which were surface-condensing, and of a type then in vogue; these consisted of two oscillating cylinders (each 80¼ inches diameter, and 5 feet 6 inches stroke) working upwards, and being geared down to the propeller shaft by ordinary tooth gearing. The pressure carried was 25 lbs., and her average speed was about 12 knots.[1]

Another famous screw-steamer brought out by this company was the **Russia**, which was put on the service in 1867. She was of slightly larger dimensions than the **China**, being 370 feet long, by 43 feet broad, and 29 feet deep, and 3100 tons. She was propelled by inverted direct-acting engines, having two cylinders, each 85 inches diameter, and 45 inches stroke. The vessel and engines were built by Messrs. J. and G. Thomson. She carried on the express service of the Cunard Company for a few years with the **Scotia**, but the honour of the fastest passage having been wrested from this line soon after she came out, she did not become noted for high speed, although she continued to be patronized by the majority of the saloon passenger traffic. In 1881 she was sold to the Red Star Line of Antwerp, and by them lengthened and fitted with compound engines, and re-named the **Waesland**; and still continues to "bridge the ocean," having in 1890 been re-fitted with triple engines.

[1] In 1852 iron screw-steamers were built by this line for their Mediterranean and Boston services.

After the **Russia**, the Cunard Company still continued to add new iron screw-propelled vessels to their fleet; but none of them became prominent, as they were rather behind the time in design and arrangements of hull and machinery, and in passenger accommodation. Their first vessel with compound engines was the **Parthia**, brought out in 1870, followed in the same year by the **Algeria** and **Abyssinia**, which had ordinary expansion vertical engines. In 1874 came the **Bothnia** and **Scythia**, fitted with compound engines (the latter becoming noted owing to a large whale striking the propeller in July 1875), and were followed in 1879 by the **Gallia**, fitted with three-crank compound engines, and in 1881 by the **Servia**. This huge vessel, like the other Cunarders about this period, was built and engined by Messrs. J. and G. Thomson, of Clydebank. She was 515 feet long, 52 broad, 38 deep, and 8500 tons; the engines were of the ordinary compound vertical three-crank type, the high-pressure cylinder in the centre being of 72 inches diameter, and each of the low-pressure 100 inches, with a stroke of 6 feet 6 inches.

The **Servia** was practically the first of what may be called the Express Transatlantic Service, as, owing to the immense space required for the powerful machinery necessary for the high speed beginning to prevail, but little room was left for cargo. Another reason for the greater attention given to passenger traffic was the large number of slow, small-powered, big-carrying modern cargo-boats commonly called "tramps," which were flooding the freight market with tonnage and so cutting down rates.

Although the first steel vessel, and the first with a cellu-

lar bottom in the Express Service, the **Servia** was not the first in the North Atlantic trade, that honour belonging to the Allan Liner **Buenos Ayrean**, built and engined by Denny, of Dumbarton, in 1879, and the **Parisian**, built by Napier in 1881. In 1882 another Cunarder, the steel **Aurania**, also built by J. and G. Thomson, came out, and represented a new departure suggested by the builders, which was, in fact, a reaction against the then prevailing proportions of length to beam, which was generally 10 or 11 to 1. In this craft these proportions were altered to about 8 to 1, the dimensions being 470 feet long, 52·2 feet broad, 37¼ feet deep, and 7270 tons. The engines were almost of the same design and size as the **Servia's**.

Neither of these vessels attained the honour of the much-prized "fastest record passage," and beyond the fact of the **Aurania** having become noted for a serious breakdown of machinery which disabled her for months, they have not been famous.

As may be surmised by the number of vessels which about this time were being brought out by the Cunard Line, they were endeavouring to gain the "premier position" on the Atlantic which they had now relinquished for over fifteen years; and it is remarkable that it was by the purchase of a vessel from a competing company, which had already beaten the record, that they at last succeeded in regaining it. This vessel was the magnificent but ill-fated **Oregon**, which they purchased and first sailed June 7th, 1884, and which will be commented on later. Suffice it here to say, that after two short years of very successful working for the Cunard Line, and a short experimental

service under the British Admiralty, during which she afforded admirable experience, her career was suddenly terminated by colliding with an American wooden schooner off Fire Island, outside New York Bay, on March 11th, 1886.

This memorable event startled the whole maritime world, and the usual alarming statements and prophecies about bulkheads once more became fast and furious; but that the ingenuity and care of both ship-builders and ship-owners had not been thrown away, is shown very distinctly by the fact that the Cunard Line still retain their noted record of *never having lost a passenger's life*, whereas had the bulkhead division (which was identical with that first introduced by Messrs. Harland and Wolff) not been efficient and of sound workmanship, thus enabling her to be kept afloat for some hours, it is more than probable that the loss of life would have been appalling.

Amongst the numerous vessels brought out by the Cunard Line, none have become more famous than the well-known **Umbria,** which first sailed October 31st, 1884, and the **Etruria**, on April 25th, 1885. They were of steel, 500 feet long, 57¼ feet broad, 38¼ feet deep, and 7718 tons. They were built by the firm of John Elder and Co., then re-constituted under the name of the Fairfield Shipbuilding and Engineering Co., which had also built the **Oregon,** whose satisfactory performances had no doubt led to the placing of the order with them; and it is worthy of notice that these were the first vessels actually built for the line which succeeded in making the fastest record passage in recent times.

In December 1892, the first-mentioned vessel became

H.M.T.S. CAMPANIA AND LUCANIA (1893). CUNARD LINE.

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noted owing to the breaking of the thrust-shaft at sea on an outward passage, but it was so skilfully repaired by the engineers as to enable her to complete the voyage to New York under her own steam.

The latest vessels brought forth by this line are at present the largest and finest in the world, and are named the **Campania** and **Lucania**, the former being launched from the Fairfield Shipbuilding and Engineering Co.'s yard, at Glasgow, on September 8th, 1892, and the latter on February 2nd, 1893. These immense vessels are built of steel and fitted with twin screws, and are each 598 feet long, 65 feet broad, and 43 deep, and of 12,950 tons. Only two masts or flag-poles are fitted, and also two immense funnels. As they were built especially to be the fastest ocean-going vessels afloat, enormous engine and boiler power has been put into them. The two sets of engines are triple expansion, with 5 cylinders for each set, that is with a high (37 in. diameter) and low pressure (98 in. diameter) placed tandem fashion on the forward and also on the after crank shaft, and one intermediate cylinder (79 in. diameter) on the middle crank shaft, making ten cylinders in all. The indicated horse-power of the two sets of engines combined ranges over 30,000, and to supply them with steam there are 12 double-ended boilers, with 96 furnaces, and 1 single-ended with 4 furnaces, carrying 165 lbs. pressure, which have a consumption of over 400 tons of coal per 24 hours, the speed per hour ranging about 22 knots. The saloon (which is between the funnels) and state-rooms are slightly after the plan of the **Majestic** and **Teutonic**, but without the single berth

system; the arrangement of the stern for the propeller shafts is also similar, but the rudder, which consists of a steel frame, and one plate measuring 21 feet by 11 feet 3 inches and 1¼ inches thick, is made and fitted somewhat after the manner of that on the **New York** and **Paris** (see p. 51), but in these vessels a projection is made on both sides of the hull proper to make room for the tiller on the rudder-head, which is worked by steam gear. The saloon measures 85 feet by 63 feet, and is capable of seating over 400 passengers at one time. As may be imagined from the great dimensions of hull and machinery, the cost of these vessels far exceeds that of any merchant steamer yet built, ranging about £650,000 for each vessel, or £1,300,000 invested in the two.

Following the inevitable laws of nature and the dictates of the great manipulator, Father Time, the proprietary of this great line, like its vessels, has had to undergo change; the first being the handing over of the private ownership from the founders, Cunard, Burns, and MacIver, 1878, to a private company entitled "The Cunard Steamship Company, Limited," and registered on February 23rd, 1878, with a capital of £2,000,000 in 20,000 shares of £100 each. This was changed again to a public company in 1880, the shares being eagerly taken up by the public. Some time afterwards, early in 1883, the Messrs. MacIver withdrew from the company, and the management was taken over by the directors, assisted by a responsible manager and officials under the direct supervision of Sir John Burns, the present chairman, under which *régime* it now remains.

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THE COLLINS STEAMERS ATLANTIC (1849) AND ARCTIC (1850).

Following the Cunard, the next great steamship effort to be noticed is the commencement of the once famous Collins Line, which was founded in the United States in 1848, to wrest, if possible, the trade from the English steamers. This line commenced its first sailing on April 27th, 1849, from New York for Liverpool, by despatching the **Atlantic**, one of four splendid wooden steamships, the others being named **Arctic**, **Baltic**, and **Pacific**, each of which measured 282 feet long, 45 feet broad, and 31½ feet deep, with a tonnage of 2860 tons, built by William Brown, at New York. These fine vessels were a great advance upon the Cunarders then existing, and were the first to have straight stems, and to be fitted up with smoking-rooms, specially set apart for the purpose; other luxuries were the spacious bath-rooms and barbers' shops, and on one or two of the vessels the saloons at first were placed amidships.

The machinery of the **Atlantic** and **Arctic** was constructed by the Novelty Ironworks, and of the **Baltic** and **Pacific**, by the Atlantic Works, both of New York, and were all of the side-lever type, having cylinders 96 inches diameter, and 10 feet stroke. The boilers, four in number, were arranged with two rows of furnaces, one above the other, and were fitted with vertical tubes 2 inches diameter. Steam was carried at 17 lbs. pressure on a consumption of about 85 tons per day. The paddles were 35½ feet diameter, the average speed about 11¾ knots per hour. Every effort which skill and science could command was put forth in the equipment of these vessels, each costing over £165,000; but cost was considered no object

so long as they outstripped the best performances of the Cunard vessels. In this they were successful, but financially they were not, owing, no doubt, to the lavish expenditure; and in September 1854, they received a terrible blow in the loss of the **Arctic**, which was run into by a small French steamer named the **Vesta**, off Cape Race, in a dense fog, and sunk with a loss of 322 lives, amongst whom were the wife, son, and daughter of Mr. Collins, the managing director and promoter of the line.

About two years after this another great disaster befell them in the loss of the **Pacific**, which sailed from Liverpool on June 29th, 1856, but as to her fate nothing was known, the brief and terrible sentence, "Never heard of," being the only tale of how a noble vessel and her living freight were suddenly engulfed in eternity. The last of the great wooden paddle-steamers, the **Adriatic**, brought out by the Collins Line, arrived in Liverpool in December 1857, and was by far the finest and fastest vessel built up to that date. She was constructed by Steers, at New York, and was 355 feet long, by 50 feet broad, and 33 feet deep, her gross tonnage being 3670. The machinery was constructed at the Novelty Ironworks, New York, and consisted of two oscillating cylinders each 100 inches diameter and 12 feet stroke, indicating 3600 horse-power, with a boiler pressure of 20 lbs.; the paddles were 40 feet diameter, and at 17 revolutions per minute gave a speed of 13 knots on a daily consumption of 85 to 90 tons. Upon the withdrawal of the Collins Line in January 1858, she was laid up, then sold to be put upon the service from Galway (Ireland), promoted in 1861; but the line being unsuccessful she was

again laid up in Birkenhead, and afterwards sold to serve as a hulk in the west of Africa, where she still exists. The two remaining vessels, **Atlantic** and **Baltic**, were converted into sailing-ships and were afloat until recent years, but have now disappeared.

The continued success of the Cunard Line soon brought forth others anxious for a share of the great profits which were being reaped. In 1847 the Americans established a line to trade between New York and Bremen, touching at Cowes in the Isle of Wight: it was called the Ocean Steam Navigation Company, and contracted to carry the United States mails twice a month. It lasted, however, only a few years, being very unsuccessful.

In 1848 the Americans formed another line of vessels to ply from New York to Havre, touching at Southampton, under the name of the New York and Havre Steam Navigation Company. They commenced running in 1850, with a large subsidy from the United States Government for carrying the mails. The vessels of this line were also very unfortunate, two of them having been lost within twelve months, a misfortune which caused the company to be dissolved some time afterwards.

CHAPTER III.

THE INMAN, ANCHOR, AND ALLAN LINES.

JUST ten years after the foundation of the Cunard Line (namely in 1850), a line which for forty-two years afterwards held a front rank on the Atlantic Ferry made a small beginning with an entirely different type of vessels from the form then existing. This was the formerly well-known Inman Line, and was announced in the papers by the following advertisement in the *Liverpool Mercury*, Dec. 6th, 1850—

"*Steam communication between Liverpool and Philadelphia.*—The powerful screw steamship **City of Glasgow**, B. E. Matthews, late of the **Great Western**, Commander, 1610 tons, 350 horse-power, is intended to sail as under:

"*From Liverpool.*—Wednesday, 11 Dec.; Wednesday, 12 Feb., 1851. *From Philadelphia.*—Thursday, 16 Jan., 1851; Thursday, 13 March.

"This vessel is well known from her successful voyages between Glasgow and New York, and has ample state-room accommodation for about 120 first and second cabin passengers; no steerage passengers taken.

"*Rates of Passage.—From Liverpool.*—1st Cabin, 22 guineas; 2nd Cabin, 13 guineas. *From Philadelphia.*—1st Cabin, 100 dollars; 2nd Cabin, 60 dollars.

"These rates include provisions and steward's fee, but not wines or liquors, which can be had on board.

CITY OF GLASGOW (1850). FIRST INMAN STEAMER.

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"*Rates of Freight.—From Liverpool.*—£4 per ton measurement. *From Philadelphia.*—According to agreement.

"Passengers and shippers will find Philadelphia the most central port, possessing railway communication in a few hours and at trifling expense to New York for the North; being also on the main line from the North through Baltimore to Washington and the Southern States, and the great central railway (now open to within 80 miles of Pittsburg on the Ohio) forms the shortest and most direct route to the Western States. All goods sent to the agents in Philadelphia will be forwarded with economy and dispatch.

"For further particulars apply in Philadelphia and New York to Richardson, Watson and Co.; in Belfast to Richardson Brothers and Co.; in Glasgow to Patrick Henderson and Co.; and in Liverpool to

"RICHARDSON BROTHERS AND CO.,
"12 and 13, Tower Buildings,
"Liverpool."

This service was founded by Mr. William Inman, of Liverpool, in conjunction with the firm of Richardson Brothers, of the same place, the intention being to trade between Philadelphia and Liverpool. Their first steamers were the **City of Glasgow** and **City of Manchester**; the former, which was originally built to trade between Glasgow and New York, was described as follows by the *Glasgow Courier*—

"A NEW ATLANTIC STEAMER.

"Our citizens will shortly have the gratification of witnessing the starting from the Broomielaw of the first ship of a line of magnificent steamships to sail direct between Glasgow and New York. The honour of this undertaking is due to the enterprise of our townsmen, Messrs. Tod and M'Gregor, who have already their first

vessel in a state of considerable forwardness, and is expected to be ready for launching from the stocks by the end of February.

"The **City of Glasgow**, for such is to be the distinguishing name of the splendid steamship now rapidly approaching completion in Messrs. Tod and M'Gregor's yard, is built of iron, and is of imposing dimensions, although her beauty and symmetry apparently detract from her real magnitude. She is a three-decker, of about 1600 tons measurement over all, and is to be propelled by a screw 13 feet in diameter and 18 feet pitch, which is to be worked by two lever beam-engines of 350 horse-power. The machinery, etc., will all be placed so low as to leave the sweep of the decks clear without encumbrance. The spar-deck will form a magnificent promenade in fine weather, and in foul weather the main-deck affords ample space for recreation, perfectly lighted and ventilated, and protected from rain or spray. The total length of the main-deck is 237 feet, and the breadth 34 feet. On each side are ranged the state-rooms, leaving 16 feet clear in the centre. The height between decks is 7 feet.

"The accommodation for each class of passengers is admirable and most complete. She will carry 52 cabin, or first-class, passengers, 85 second-class, and 400 steerage emigrants. The crew, including officers, engineers, firemen, stewards, sailors, etc., will probably number about 70, so that she will carry a total living cargo of upwards of 600. Two of the state-rooms for first-class passengers have four berths in each, all the others have only two. The state-rooms for second-class passengers have four and eight berths in each. The state-rooms for ladies are so capacious that they may be used as sitting-rooms, should they choose to retire from the main-cabin. The latter is an apartment of noble dimensions, and will be elegantly fitted up, and furnished with a well-assorted library. The walls will be decorated with panellings representing views of places of interest on both sides of the Atlantic. One room is being fitted up as an apothecary's shop, from which the surgeon

will dispense his medicines. Near this is the bath-room, with apparatus for pumping up the salt water from the Atlantic. In fact, nothing has been left undone which science and ingenuity can suggest to add to the comfort and convenience of the passengers. Nor has their safety been uncared for in the construction and fittings of this noble ship. By means of five water-tight bulkheads the vessel is divided into six compartments, so that she would float although several of these divisions were filled. She will be furnished with six capacious lifeboats, having copper tanks under the seats to render them buoyant. Danger from fire has likewise been carefully guarded against. The lamps which light the state-cabins can only be opened by the officers of the ship; and powerful pumps, to be worked by the engines, are supplied so as to extinguish at once any fire which might break out. In the bottom of the hold are placed iron tanks to contain 13,000 gallons of fresh water. There will be ample storage for 1200 tons of goods.

"In addition to the screw motive power the **City of Glasgow** is barque-rigged, and will carry an enormous press of canvas."

The **City of Manchester** was also built of iron, upon the Clyde, by Messrs. Tod and M'Gregor, and was 258 feet long, 34½ feet broad, and 25 feet deep, and of 2125 tons, and had overhead geared engines of 350 horse-power, constructed by the same firm, with cylinders 71 inches diameter, and stroke of 5 feet, driving a two-bladed screw-propeller. Steam at 10 lbs. pressure was generated in three boilers having nine furnaces. With the advent of these vessels commenced the long-waged war of paddle versus screw ocean steamers; so that although the **Great Britain** had been previously in the trade, to the Inman Line belongs the honour of having introduced the first successful iron screw-

steamer, to which Company's notice it was brought by Mr. Tod, of the firm that built the vessel. Another important trade first inaugurated by Mr. Inman was the carrying of steerage passengers by steamships, which traffic was then altogether monopolized by the sailing ships already mentioned. The first sailing was the **City of Glasgow**, which left Liverpool on December 11th, 1850, for Philadelphia, followed soon after by the **City of Manchester**, **City of Philadelphia**, and others. In 1856 they commenced sailing to New York with the **City of Washington**, which, proving a more suitable port, Philadelphia was given up, and in 1857 they commenced calling at Queenstown by the **City of Baltimore** on the 12th May, from which date this port of call became known to the Atlantic Ferry. After the former event the direct rivalry between this line and the Cunard commenced; the latter having by that time got rid of their old rival the Collins Line, now found another coming forward with a modern style of screw-steamship, to compete with them for a share of the enormous subsidies which were at that time in vogue.

This rivalry soon bore good fruit as far as the public were concerned, as each succeeding new vessel was always built to outstrip the performances of the other line's crack ship, as well as to surpass it in the elegance of the fittings.

In 1869 the Cunard Company, in the matter of speed, was eclipsed by the performances of the Inman steamer **City of Brussels**, which made a splendid run home of 7 days, 22 hours, 3 minutes; and as the first **City of Paris** had in 1867 made the fastest outward passage, their rival had to yield the palm.

The first **City of Paris** was built and engined by Tod and M'Gregor of Glasgow in 1866, and was 346 feet long, 40¼ feet broad, and 26 feet deep, and of 2651 tons, her engines being of the horizontal trunk type, with cylinders of 89 inches diameter, and 3 feet 6 inches stroke, consuming 105 tons per day, the speed being 13½ knots per hour. This fine vessel was afterwards lost at sea in March 1885, under the name of the **Tonquin.**

After the advent of this vessel in 1866, great public interest was excited in the doings of the vessels of this line and the Cunard as to which would make the fastest record, the voyages of this vessel and the **Russia** being eagerly watched; but in November 1867 she succeeded in beating the record, viz., in 8 days 4 hours, on the outward run; and in 1869 the **City of Brussels** made the homeward record of 7 days, 22 hours, 3 minutes, which records were retained by the line until 1872.

The **City of Brussels**, built by the same firm, was launched in 1869. She was 390 feet long, 40¼ feet broad, 27 feet deep, and of 3081 tons. The engines were horizontal direct-acting trunk engines with surface condenser, having two cylinders each of 90 in. diameter, 4½ feet stroke, and steam pressure of 30 lbs., which propelled her at a speed of nearly 14½ knots on a consumption of 110 tons per day.

One of those important details which are so vital in the successful working of these great vessels was first adopted on this ship, namely the steam steering gear which had recently been introduced and tested on the **Great Eastern.** This valuable auxiliary was designed and successfully

worked out by Mr. MacFarlane Gray of the famous Vauxhall Foundry, Liverpool, owned by George Forrester and Co., which has since disappeared like some of the other great firms, such as Woods, Vernon, Jack, and others who have helped on the great civilizer of our day—the ocean steamship.

The career of the **City of Brussels**, the first to reduce the passage to under eight days, in December 1869, deserves notice, for she was the last of a type of steamship which was at this date much in vogue, having a long narrow wooden deckhouse with high bulwarks, giving but limited space to the passengers. This was afterwards done away with in 1872, another deck being added and other extensive alterations made to enable her to compete with newer rivals which had come upon the scene. Later, in 1876, the original engines and boilers were removed and replaced by four-cylinder tandem compound engines, and in the year 1877 she was the object of attention, owing to a very long delay in arriving caused by the breakage of the shaft, as there were on board many Catholic pilgrims bound to Rome on the occasion of the jubilee of his Holiness Pius IX.

In 1883 her career was suddenly ended by a collision with a steamer named the **Kirby Hall**, which cut into and sank her in a dense fog, off the mouth of the Mersey, on January 7th, 1883.

Following the usual order of things, this famous vessel was succeeded by others to maintain the efficiency of the fleet. The **City of Richmond** and other vessels were brought forward, and in 1875 the **City of Berlin** commenced

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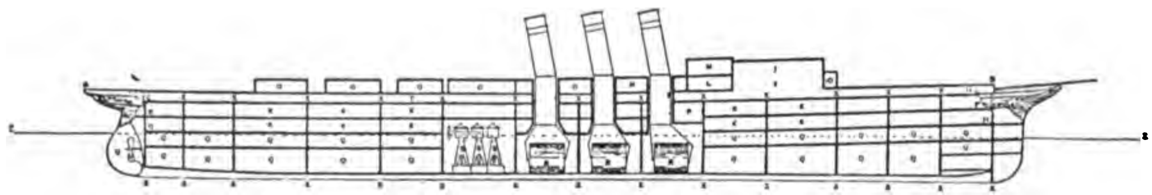
THE INMAN LINE CITY OF ROME (1881), AS ORIGINALLY RIGGED.

sailing. This fine vessel was built and engined by Messrs. Caird, of Greenock; she was 488¼ feet long, 44¼ feet broad, 35 feet deep, and of 5491 tons. The engines were of the two-cylinder compound two-crank vertical type, with cylinders of 72 and 120 inches diameter, and stroke of 5 feet 6 inches, the boiler pressure being 75 lbs., generated in twelve boilers having thirty-six furnaces. The consumption per day was about 120 tons, and her average speed about 16 knots on the passages made outward in September and homeward in October 1875. These were the fastest ever made up to that time, and were much commented upon, the record being wrested from the newer rival, the White Star Line, which, commencing in 1871, had till then held the premier position. The first use of the "electric light" in this trade was made in this steamer, which was fitted with it in November 1879. In 1887 new triple expansion engines and boilers were supplied by Messrs. Laird, of Birkenhead, and forced draught on the Howden system fitted.[1]

After a period of six years, during which time other lines were bringing forward noble vessels to obtain the much-prized "fastest passage," another beautiful vessel, the **City of Rome**, was launched for this line at Barrow, on June 14th, 1881, and sailed on her first voyage from Liverpool, October 13th, 1881. This graceful vessel was the subject of much comment when being built, but the great expectations entertained were, however, not realized. The construction of the hull, beyond being exceptionally

[1] This has recently been altered to the new system of induced draught, introduced by Messrs. J. Brown and Sons, Sheffield.



AB Promenade Deck.
CD Saloon Deck.
EF Upper Deck.
GH Main Deck.
I First Cabin Dining-Saloon.
J Dome of Dining-Saloon.
K State-Rooms.
L Drawing-Room.
M Bridge.
N Library.

O Promenade Deck Suites and Cabins.
P Kitchen.
Q Cargo Compartments, Baggage, and Store-rooms.
R Boilers.
S Engines.
T Smoking-Room.
U Rudder.
V One of the Twin Screws.
XX Water-tight Bulkheads.

BULKHEADS OF THE CITY OF NEW YORK AND CITY OF PARIS.

strong, calls for no comment. She was built of iron throughout, and was 560 feet long, 52¼ feet broad, and 37 feet deep, and of 8144 tons; three funnels were for the first time fitted, which being uniformly spaced with four masts, gave the vessel a noble appearance in conjunction with the graceful bow and general outline of the hull. For the machinery, which was also by the Barrow Company, the three-crank engine was adopted, but it differed from the other types in the fact that there were six cylinders, three high-pressure, each 46 inches, and three low-pressure, each 86 inches diameter, fitted tandem fashion, with a stroke of 6 feet. A great departure was made in the working of the slide-valves by means of spur-wheels, which geared the weigh-shaft (on which the eccentrics were fitted) with the crank-shaft, and thus enabled the valves to be fitted at the back of the cylinders. Hollow shafting was also fitted throughout, except for the propeller length.

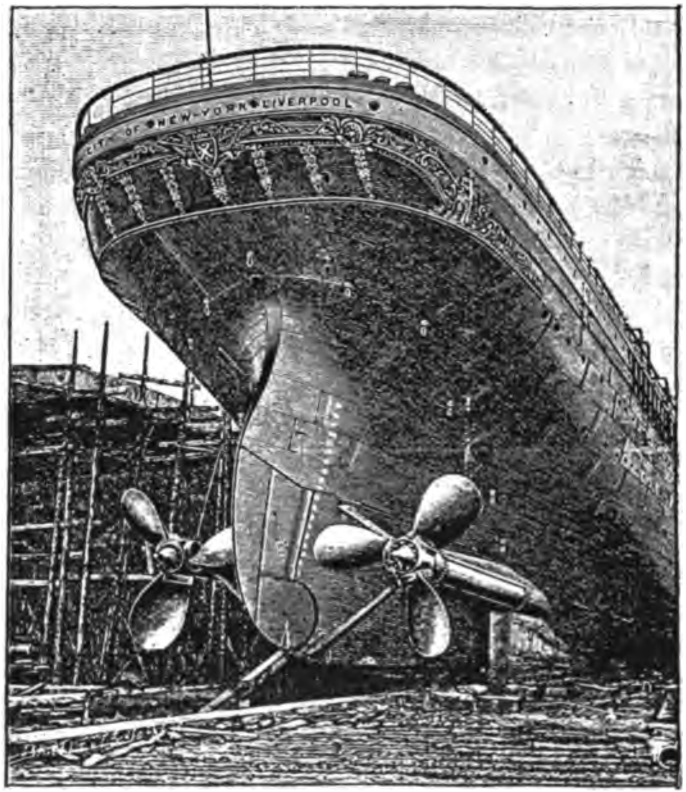
The boilers, which were of the usual type in iron, carrying 90 lbs. pressure, were eight in number, with forty-eight furnaces placed two and two in fore and aft line, which enabled a water-tight bulkhead to be fitted fore and aft on each side, so as to form the coal bunkers; this excellent arrangement was, however, altogether altered, as well as other parts of the machinery, after she was returned to the builders, with a view of attaining a speed more in accordance with the newer Atlantic vessels. After completion of these alterations, she was again put in the Express Service, under the auspices of the Anchor Line, in 1884, where she remained until 1891.

With the exception of the **City of Chicago**, bought to replace the **City of Brussels** in 1883, no steamers were added to this line until the new *régime*. The Inman and International (noticed later) placed upon the service the famous twin screw steel steamers then known as the **City of New York**, in March 1888, and **City of Paris**, in April 1889.[1] The introduction of these splendid ships to the Express Transatlantic Service marks one of those epochs of complete transformation in type of vessel, which, as the years roll by, the demands of the public necessitate and the advance of engineering science renders possible. In the design and construction of hull and machinery great advances were made, steel being very extensively used; and following the idea of the builders, Messrs. J. and G. Thomson, great breadth of beam was adopted, the most minute subdivision into water-tight compartments, effected by numerous transverse and, for the first time, fore and aft mid-line bulkheads. These were rendered practicable on account of the adoption, for the first time, in the Express Service, of the " twin screw " system of propulsion. Another great novelty was the adoption of the water chambers, to lessen the rolling in a sea-way.

The general outline was somewhat after the handsome appearance of the **City of Rome**, there being three funnels and three pole-masts with but little sail power, the introduction of the twin screws having evidently sounded the death-knell of all the time-honoured and romantic associations of the glistening sail and flowing sheet.

[1] Owing to the reorganization of the line in 1893 as the American Line, these vessels are now known as the **New York** and **Paris**.

The machinery consisted of two separate (port and starboard) sets of three-crank triple engines possessing all



STERN OF CITY OF NEW YORK, SHOWING PATENT RUDDER AND TWIN SCREWS.

the latest improvements; the boilers being fitted with forced draught on the closed stokehole system, and carry-

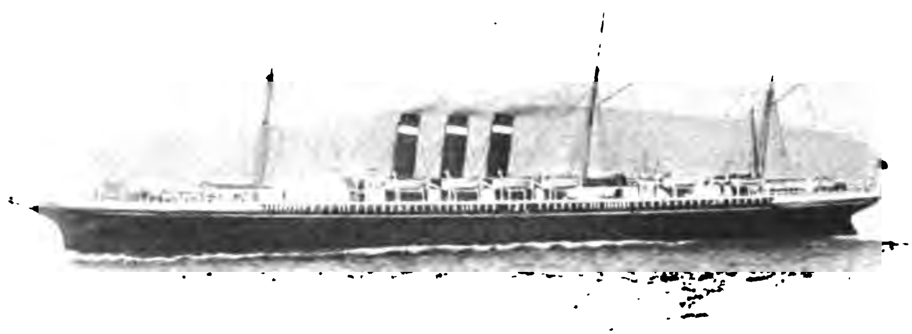
ing 150 lbs. pressure.[1] One of the most marked innovations which deserves notice was the new arrangement of the rudder; this, unlike the usual type, had no part above the water-line, although the hull was so outlined or built as to look as if there were, but in this case the rudder proper only reached to a foot or two below the water-line, having the stock passing through a water-tight stuffing-box into a compartment in the run, in which a powerful steering gear was placed. This, like all the other auxiliary machines on board, was worked upon Brown's hydraulic system, which was hitherto entirely unknown in this trade.

The first of these fleet argosies was the **City of New York**, which came out in 1888, and was followed in 1889 by the **City of Paris**; the splendid runs of the latter soon brought them to the front rank, and in May 1889, the honour of being the first to reduce the passage to below six days fell to the **City of Paris**.

Public attention was much turned to this vessel early in 1890, owing to an accident of exceptional magnitude, which occurred to the machinery on March 25th, 1890, when nearing the Irish coast on a homeward run; this, as is now well known, consisted in the complete wrecking of the starboard engine, caused by the breakage of the shaft at the tube mouth.

Since the advent of these two vessels no others have been added to the time-honoured Inman Line, which has now passed away for ever, as also the prefix City,

[1] Howden's system of forced draught has since been fitted on steamship **City of Paris** in 1891.



CITY OF NEW YORK (1888) AND CITY OF PARIS (1889).
(Inman and International Line.)
First Twin Screw Express Atlantic Liners.
1893, American Liners "New York" and "Paris."

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these two fine vessels having been removed from the Liverpool route to the Southampton, and from under the English flag to that of the United States, in March 1893, and are now known under the simple names of the **New York** and **Paris**, as are also the other vessels **Berlin** and **Chester**, although the latter still remain under the British flag. Like that of the Cunard Company the proprietary of the Inman Line has undergone changes. It passed first from the private ownership of its energetic founder, Mr. William Inman, to a private limited company in 1875, which afterwards, in September 1886, endeavoured unsuccessfully to raise additional capital by the public issue of debentures. The whole organization and fleet was then purchased by the International Navigation Company of the United States, better known as the Red Star Line, and the entire management altogether passed from the well-known name of Inman and the original house flag to that of an American ownership represented in England by Messrs. Richardson, Spence and Co., and was continued under the well-known "I and I" house flag and name of the Inman and International Line until March 1893, when, to satisfy the longings of the American nation to have a first-class line of their own, the whole undertaking was reorganized, and the name changed to the American Line, with a spread eagle house flag, and the two principal vessels, **New York** and **Paris**, transferred to the United States flag, the law which had hitherto existed preventing any foreign-built vessel from flying the flag (United States) being modified to allow of their being so transferred.

Following this important change the route of the steamers also was altered from Liverpool and New York to a direct service from New York to Southampton, which was inaugurated by the arrival there of the **New York** on March 4th, 1893, from whence she sailed again on March 11th.

At the same time that these changes were being effected, and to comply with the United States laws, an order was placed with Messrs. Cramp of Philadelphia to build vessels which are to eclipse, if possible, the doings of the British-built crafts.[1]

In 1851 a line was formed in Glasgow to trade between that port and New York City, under the name of The Glasgow and New York Steam-packet Company. The first steamer, the **Glasgow**, sailed in 1851, and was followed by the **New York** and **Edinburgh**. The line was fairly successful until 1858, when the **New York** was lost, which proved the first step downwards, for soon afterwards the other steamers were sold, and the line was broken up in 1859.

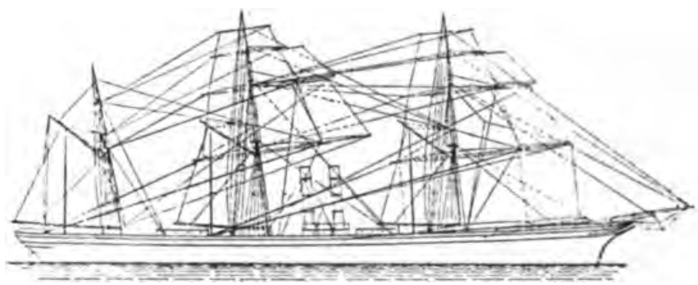
The first successful line from Glasgow was that known as the Anchor Line, in 1856. This line, under the management of Messrs. Handyside and Henderson, commenced by despatching the steamer **Tempest** to New York. This trade was, however, only carried on as a secondary one to their Mediterranean trade until 1863, when they commenced with large steamers, the first two being named

[1] The dimensions of these vessels are reported to be 510 feet long, 63 broad, 41 deep, and of 6800 tons, the indicated horse-power to range about 1500, and speed 20 knots.

Anchor Ld 1856

the **Britannia** and **Caledonia**. The trade increased so rapidly that it was soon found necessary to commence weekly sailings.

One of the modern innovations introduced by this now extensive line was the carrying of dead meat by the dry air process of refrigerating. This was effected on board the **Circassia** by means of machinery specially arranged and made by Messrs. Bell, Coleman and Co. The enormous trade now carried on in this particular service to every part of the world dates from this successful venture, which was made in March 1879; the first actual



CANADIAN (1854), FIRST STEAMSHIP OF THE ALLAN LINE.

experiment was, however, that of the s.s. **Strathleven** in the Australian trade, fitted towards the end of 1878 by the same firm of Bell, Coleman and Co.

The next expansion of the Transatlantic service which is to be noticed was designed to connect Canada with the mother country, and to this end a contract was entered into (in August 1852) by a firm in Liverpool, named MacKean, MacLarty, and Lamont, with the Canadian Government for an annual subsidy of £24,000. Early in 1853

the first steamer, **Geneva**, sailed from Liverpool for Quebec, and was followed by others named the **Ottawa**, **Cleopatra**, etc. The service lasted until late in 1854, when it came to an end through the Crimean war causing a demand for steamers as "troopers."

After the termination of this service, another was soon afterwards created by Sir Hugh Allan, of Canada, in conjunction with his brothers in Glasgow, and, under the name of the Allan Line, still flourishes. The first vessel was the **Canadian**, which sailed from Liverpool, on the 20th September, 1854, for Quebec and Montreal; this was an iron screw-propelled vessel built by Denny, of Dumbarton, 278 feet long, 34 feet broad, 24 feet deep, and of 1873 tons, with inverted direct-acting screw engines by Tulloch and Denny, having cylinders 62 inches diameter, and 3½ feet stroke, the boiler pressure being 12 lbs. per square inch. Owing to this vessel and her sister, the **Indian**, being chartered by the Government, no further sailings took place until April 1856, when, under the name of the Montreal Ocean Steamship Company, an excellent service was commenced which has since been carried on regularly.

Allan Line
1856

CHAPTER IV.

THE GALWAY, NATIONAL, AND GUION LINES.

In 1857 a line was organized to trade between Galway (Ireland) and St. John's, Newfoundland, the shortest ocean route between this country and America; it commenced in June 1858, with a subsidy from the Government for carrying the mails. As the steamers were not up to the standard as regards speed and power, the service was conducted with great irregularity, and was eventually given up in 1861.

In August 1863, a line was commenced from Liverpool, making Galway the final port of call, with a subsidy from Government of £75,000 per annum; it lasted, however, only a short time, being finally given up in January 1864.

In 1863 the next line was established by some Liverpool merchants with three steamers named the **Louisiana**,[1] **Virginia**, and **Pennsylvania**, under the name of the National Steam Navigation Company, but it was not until the latter end of 1864—when the Company was reorganized under the name of the National Steamship Company—that this line became a paying one. Since that period it has carried on a regular trade, but its

[1] Afterwards called the **Holland** (see next page).

National 1863

performances have not proved remarkable, for, although the vessels are large and strongly built, they are extremely slow. Notwithstanding that their vessels do not rank among the swift class, they have been fairly successful, and in former times have carried large numbers of steerage passengers, but this trade they have now given up. Besides their Liverpool and New York trade, vessels of this line also sail from London to New York at regular intervals.

To this line belongs the honour of having first introduced the compound engines to the Atlantic trade, the **Holland** having had the original engines with 2 cylinders, each 55 inches diameter and 3 feet stroke, removed in 1869, and was fitted with new compound engines by J. Jack and Co., of Liverpool, with 2 cylinders, one high-pressure 46 inches diameter, and one low-pressure 86 inches diameter, stroke of 4 feet, and boiler pressure 60 lbs.

The most remarkable vessel of recent years placed upon the Atlantic was brought out by this Company, namely, the high-speed **America**, 432 feet long, 51¼ feet broad, 38·6 feet deep, and 5528 tons. She was designed and built of steel by Messrs. J. and G. Thomson, on their altered proportions; the engines, also by the same firm, were of the usual three-cylinder compound three-crank type, the high-pressure diameter being 63 inches, and each of the low-pressure 91 inches, with a stroke of 5½ feet, and boiler pressure 95 lbs. The advent of this vessel was much commented upon, owing to the new departure she represented, as the Company had hitherto specially refrained from the Express Service. A distinctive new

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THE AMERICA (1884). NATIONAL LINE.

feature in her arrangements was a handsome dome over the saloon, which gave it an airy and lofty appearance, and has since been imitated in the **New York** and **Paris**.

The **America** being driven at a very high speed on considerably less consumption, namely 190 tons per day, than the other "record breakers," soon took front rank. Her general appearance differed from the then prevailing type, there being only two masts and two very lofty elliptic funnels. Notwithstanding that she succeeded in breaking the record in June 1884, by a passage homeward of 6 days, 14 hours, 18 minutes, she was sold in 1886 to the Italian Government, owing to an alteration having been effected in the management of the Company, which felt reluctant to enter into such an expensive and restless competition.

Just three years after the National Line commenced, the managers of one of the then noted fleet of emigrant sailing vessels known as the Black Star Line, seeing that the steamships were drawing all the passenger trade, inaugurated the now well-known Guion Line, the founders being Messrs. Williams and Guion, the former representing the line in New York, and the latter in Liverpool. They commenced in 1866, the first vessel being named the **Manhattan**, an iron screw-propelled vessel, 335 feet long, 42½ feet broad, 28 feet deep, and of 2869 tons, having low-pressure inverted direct-acting surface-condensing engines, with cylinders 60 inches diameter, and 3½ feet stroke. This vessel and her machinery were built by Messrs. Palmer, at Jarrow-on-the-Tyne, and was followed by the **Minnesota**, **Nevada**, **Idaho**, and others; and later on, in

1870, by the now well-known **Wyoming** and **Wisconsin**,[1] iron vessels built and engined by Messrs. Palmer, each being 366 feet long, 43¼ feet broad, 34 feet deep, and of 3238 tons. The engines were amongst the first compound type in the Atlantic trade, with one vertical high-pressure cylinder, 60 inches diameter, and one double trunk horizontal low-pressure of 120 inches diameter, both working on the same crank, the stroke being 3½ feet, and having Corliss valves; these engines and original boilers, carrying 70 lbs. pressure, are still at work in 1893.

Some time afterwards, in 1872, two strange vessels named the **Montana** and **Dakota**, of entirely different design, both in hull and machinery, from the then existing type of Atlantic steamers, were brought out. Their dimensions were 400½ feet long, 43¾ feet broad, 40¾ feet deep; the engines were compound, one high-pressure, working inverted, of 60 inches diameter, on a forward crank, and two low-pressure, working horizontal, on after crank, each 113 inches diameter, with a stroke of 3½ feet, and having Corliss valves. The first boilers (carrying 100 lbs.) of the **Montana** were constructed on the principle of a series of cross tubes, 15 inches diameter, but these failed with loss of life, and were replaced by ordinary tubular boilers, carrying 80 lbs., before she commenced sailing. Although specially built to lead the van on the Atlantic highway, neither of these vessels succeeded in "breaking the record," and were both afterwards wrecked, the **Dakota** in May 1877 and the **Montana** in March 1880, at places on the Welsh coast within a few miles of

[1] This vessel was sold in May 1893.

each other. After an interval of seven years another splendid vessel, the **Arizona**, was brought forward by the Guion Line. She was of iron, built and engined by Messrs. John Elder and Co., Glasgow, and measured 450 feet long, 45¼ feet broad, 35¾ feet deep, and 5147 tons. Her machinery was of completely new design to this trade, being compound with three crank-shafts, each having one cylinder, the high-pressure, of 62 inches diameter, being in the centre, and the low-pressures each of 90 inches, with a stroke of 5½ feet. There were seven boilers carrying 90 lbs. pressure and having thirty-nine furnaces; the consumption per day averaging 125 tons, or about 25 per cent. more than the fastest vessels, **Britannic** and **Germanic**, then existing. These she succeeded in surpassing by making the fastest outward passage in May 1880, and homeward in July 1879.[1] The general design, excepting machinery, was simply a copy of these two noted vessels, as have been all the other fine vessels since brought out by the various lines.

Soon after the **Arizona** had become noted for her rapid passages, this fine vessel became more famous by performing a feat hitherto thought impossible, namely, running full speed into a huge iceberg and then returning to port to tell the tale; this remarkable episode occurred in the month of November 1879, on a homeward passage, and resulted in her putting into St. John's, Newfoundland, with her bow completely smashed and crumpled up almost to the collision bulkhead, which did good service by remaining intact. Beyond the delay and the heavy cost of rebuilding

[1] This has since been reversed, see p. 75.

a new bow, this mishap caused no injury to the vessel or the line, but, on the contrary, so proved the excellent construction of the hull that she has since continued to be well patronized.

In consequence of the success of the **Arizona**, another iron steamer, the **Alaska**, built by the same firm, of similar type, but of somewhat larger dimensions and machinery, was put into commission early in 1882, and under the pseudonym of the "Atlantic greyhound" at once became famous by making the "fastest passage," and eventually became the first to reduce the passage homeward to less than seven days in June 1882.

The last vessel to be added to the Guion fleet was the **Oregon** (already briefly noticed in the Cunard Line); this magnificent vessel, which first sailed under the Guion flag, was of iron, and was built and engined by Messrs. Elder on the same design as the two preceding vessels, but of increased size, her dimensions being 500 feet long, 54 feet broad, 40 feet deep, and 7375 tons. The compound engines were magnificent specimens of marine engineering; they consisted of one high-pressure cylinder 70 inches diameter, placed in the centre, and two low-pressure, each 104 inches diameter, with 6 feet stroke, the boiler pressure being 110 lbs., and consumption about 310 tons per day. Only a brief time elapsed after the first voyage, on which she sailed, on October 7th, 1883, before she became noted for her passages, and eventually, in August 1884, reduced the time of crossing the Atlantic to less than $6\frac{1}{2}$ days. Notwithstanding her magnificent performance with the "red-capped" funnel, she was, for financial reasons, trans-

ferred to the Cunard Line in June 1884, and, as already related, was sunk by a collision.

After many years of successful and satisfactory working under the original founders, the organization was turned into a private limited company in 1883, and after the death of Mr. S. B. Guion, which occurred in December 1885, was changed into a public one in the November of 1886, under the name of "The Liverpool and Great Western Steamship Company, Limited."

CHAPTER V.

WHITE STAR LINE.

OWING to the long period which elapsed after the formation of the Guion Line, it was thought that the Transatlantic trade had ceased to be a further field for extension, but in 1870 this illusion was dispelled by the formation of the Oceanic Steam Navigation Company, Limited, better known as the White Star Line, which now stands preeminently at the head of the great steamship companies of the globe. It was announced by the following advertisement from the *Liverpool Daily Post*, March 1, 1871, in which it may be noticed some of the names formerly used by the Collins Line were proposed though they were not adopted.

"WHITE STAR LINE, OCEANIC STEAM NAVIGATION COMPANY, LIMITED.

"The new first-class, full-powered screw steamships **Oceanic, Baltic, Atlantic, Pacific,[1] Arctic,[1] Adriatic.**

"Sailing on Thursdays from Liverpool, and calling at Queenstown on Fridays to embark passengers.

[1] These names were not adopted, those of **Republic** and **Celtic** being substituted for them.

White Star 1871

"Will sail as under for New York, viâ Queenstown. **Oceanic**, 4500 tons, 3000 horse-power, Captain Digby Murray, to sail to-morrow, Thursday, March 2nd, 1871.

"These steamships have been designed to afford the very best accommodation to all classes of passengers, and are expected to accomplish quick and regular passages between this country and America.

"The state-rooms, with saloon and smoking-rooms, are placed amidships, and cabin passengers are thus removed from the noise and motion experienced at the after part of the vessel.

"Passengers are booked to all parts of the States, Canada, and Newfoundland, Nova Scotia, India, etc., at moderate through rates. A surgeon and a stewardess carried on each ship. Drafts issued at New York for sums not exceeding £10, free.

"Parcels will be received at the Company's offices until 6 P.M. of the day before sailing.

"Bills of lading to be had from Messrs. Benson and Holme, and Mawdsley and Son. Shipping notes at the Company's office. Loading berth, S. W. corner Bramley Moore Dock.

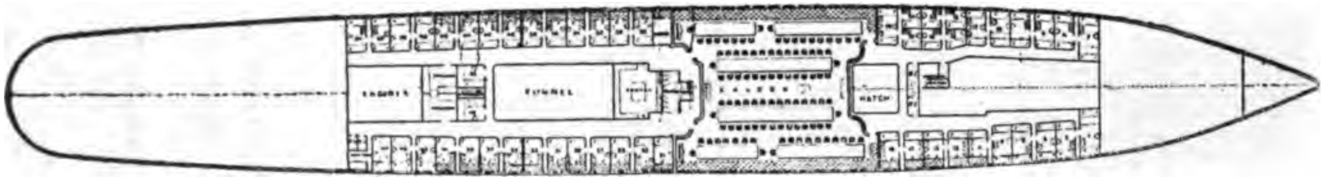
"Saloon passage, £18 18s. and £16 16s.; return ticket, 27 guineas. Steerage as low as by any other first-class line.

"Rates of freight, etc., may be obtained by applying to J. H. Sparks, at the Company's offices, 19, Broadway, New York; in Belfast, to Samuel Gowan and Co., 4, Corporation Street; or to

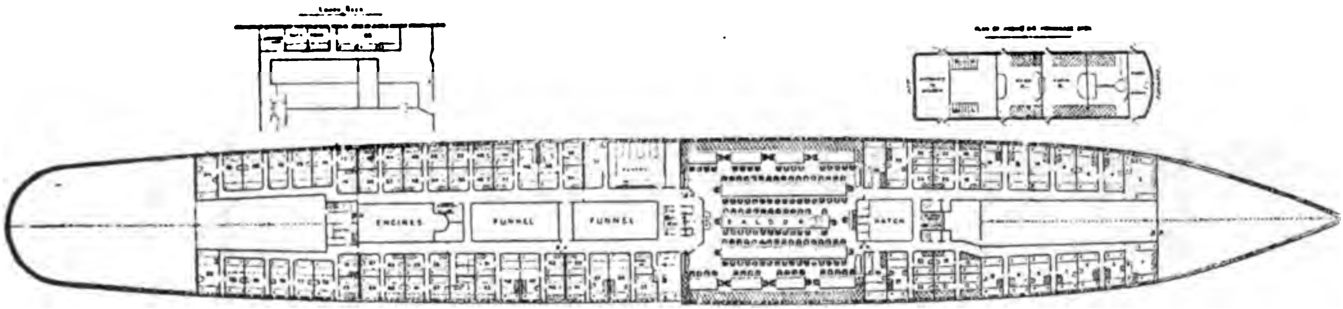
"ISMAY, IMRIE AND CO.,
"7, East India Avenue, or 10, Water Street,
"London, E.C., Liverpool."

This Company, like some of the others on the Atlantic, was an offshoot of one of the sailing clipper lines of former years, namely the "White Star."

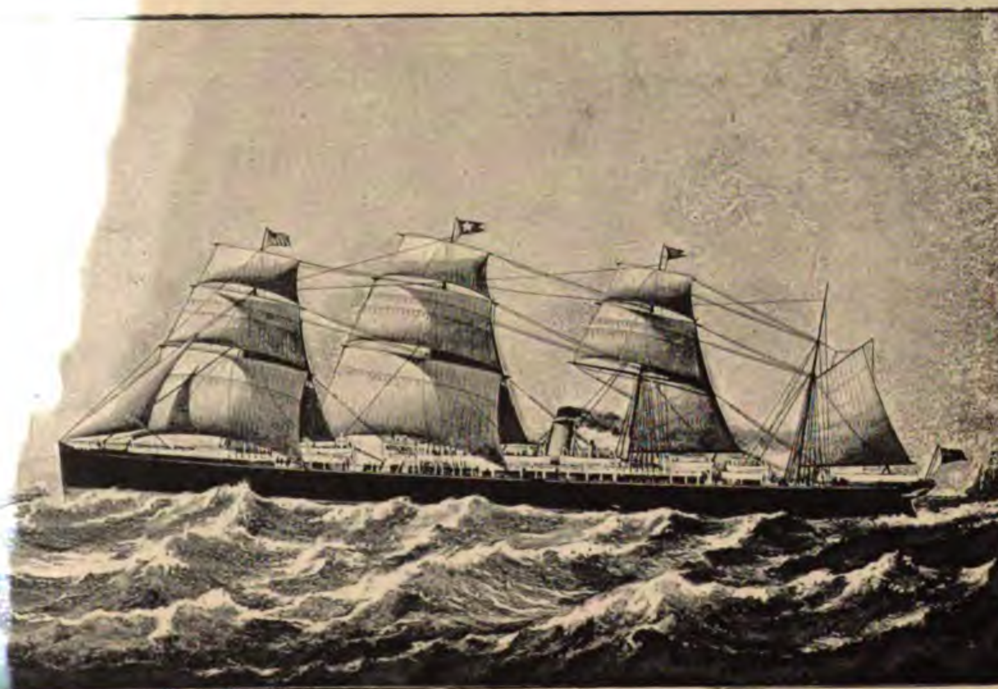
This sailing fleet having come under the management of



DECK PLAN OF THE OCEANIC.
(The first Atlantic Steamer with a midship saloon.)



DECK PLAN OF THE BRITANNIC AND GERMANIC.
(Showing the saloon accommodation.)



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THE OCEANIC (1871). FIRST STEAMER OF WHITE STAR LINE.

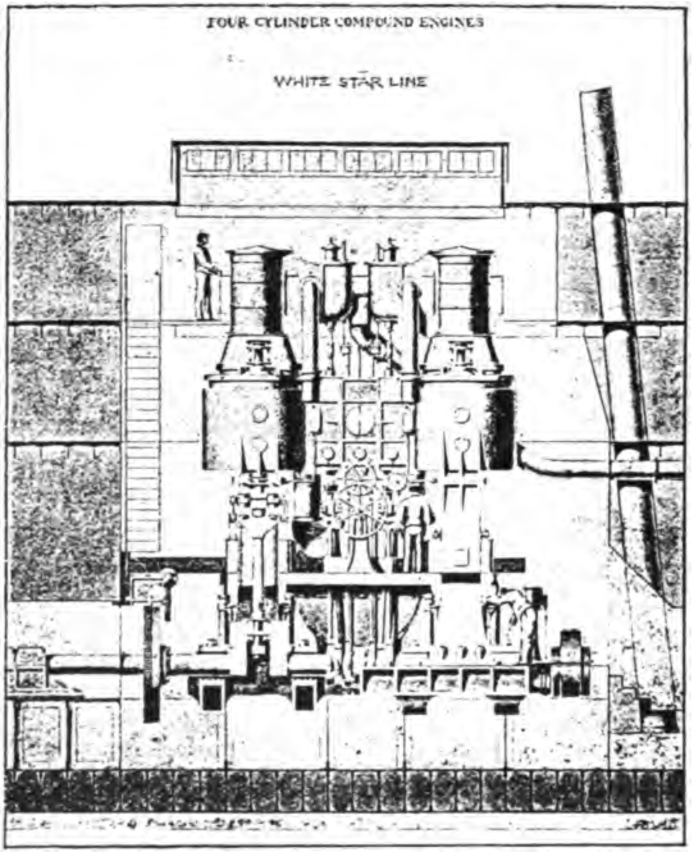
Mr. T. H. Ismay in 1867, and he having already had some experience of steamships as director of the National Line, already noticed, conceived the idea of establishing a first-class passenger line across the Atlantic with a fleet of steamers in every way superior to anything then in existence, a scheme which was by this time ripe for carrying out, owing to the radical improvements in design of hull and interior arrangements which were then being brought forward, mainly by Messrs. Harland and Wolff, of Belfast.

Being substantially supported by several influential shipping men, Mr. Ismay, in 1869, entered into negotiations with the Belfast firm to build steamers of the latest and most modern type, and in 1870 he was joined by Mr. William Imrie, who had been previously a fellow-apprentice of his.

In February 1871, their first steamer, the famous **Oceanic**, appeared upon the Mersey from Belfast; her dimensions being 420 feet long, 41 feet broad, 31 feet deep, and tonnage 3707.

This vessel will long be remembered as the pioneer of those improvements which, since her advent, have made travelling by ocean steamers so thoroughly comfortable and luxurious. The curiosity of every one connected with nautical matters was thoroughly aroused by the way in which the then existing theories and designs of steamships were in this new craft set aside. Instead of the usual high bulwarks and narrow wooden deck-houses, another iron deck was added, with open iron railings for bulwarks, so as to allow the water to come and go on deck; the

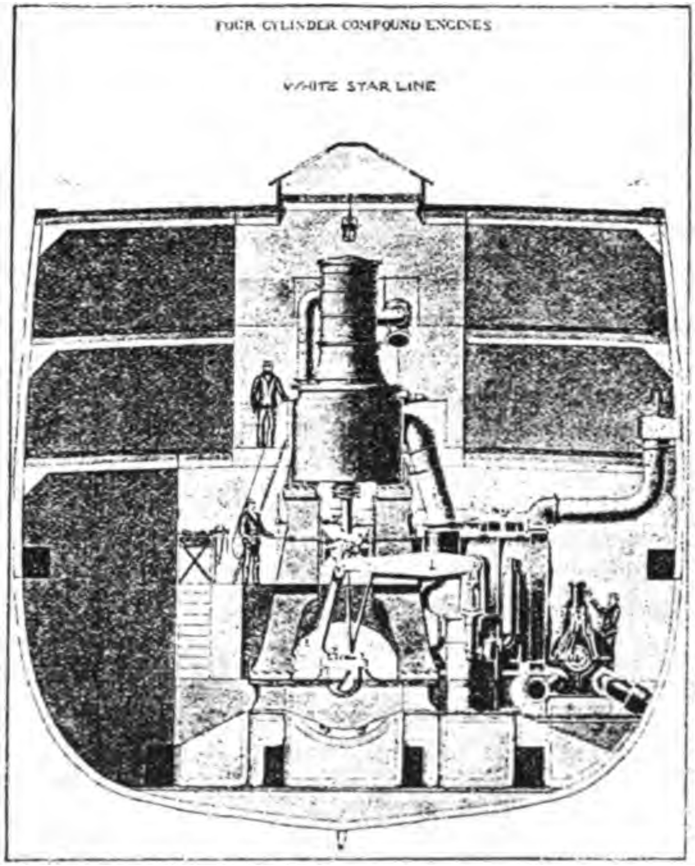
saloon was placed amidships, and extended the entire width of the vessel; both forward and aft of the saloon



ENGINES OF THE OCEANIC. SIDE VIEW.

the numerous state-rooms were arranged along both sides, and as all the sidelights were about twice as large as any

previously fitted to Atlantic steamers, the light and airy appearance of the interior soon took the attention of



ENGINES OF THE OCEANIC. THWARTSHIP VIEW.

Atlantic passengers. The engines also were objects of much attention; they were tandem compound four cylinders,

with two high-pressure, each 41 inches diameter, and two low-pressure, each 78 inches, working on two cranks with a stroke of 5 feet, so that each engine (forward and aft) formed a complete engine in itself, thus forming a double resource in case of breakdown; steam at 65 lbs. pressure was generated in twelve boilers having twenty-four furnaces, and consuming about 65 tons per day with an average speed of 14½ knots. These engines, which were by Maudslay, Sons, and Field, London, like the vessel herself, soon satisfied the doubts of all, and allayed the fears of those old "salts" who so confidently declared her to be unfit to face the heavy weather of the Atlantic. The **Oceanic** was followed by other vessels of the same type, and as the service was conducted with great regularity and unprecedented speed, they soon became famous.

In 1872 these vessels made the fastest passage outward and homeward, and in 1874 and 1875 two of the most remarkably successful steamers ever built were brought out, namely, the **Britannic** and **Germanic**; each was 455 feet long, 45 feet broad, 33¾ feet deep, and of 5004 tons, and was built of iron by Messrs. Harland and Wolff. The engines, by Maudslay, Sons, and Field, were two crank compound, tandem type, similar to those of the **Oceanic**, the high-pressure cylinders being each 48 inches diameter, and the low each 83 inches, with a stroke of 5 feet. Steam at 75 lbs. pressure was generated in eight double-ended boilers, having thirty-two furnaces, and the consumption averaged about 110 tons per day, with a speed slightly over 16 knots. These vessels were the first to reduce the passage to less than 7½ days; their splendid performances

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BRITANNIC (1874) AND GERMANIC (1875). FROM A MODEL.

have attracted world-wide attention, and although they are now nineteen years old, they still retain their place on the Express Transatlantic Service, sailing every fourth week from each port, and having the original engines and boilers.

Many comments have from time to time been made by the scientific and shipping press upon the performances of these twin vessels, which since their advent have been the basis for the design and arrangements of all the successful passenger steamers since built for any trade.

Commenting upon their excellent doings, *The Engineer*, of October 31st, 1884, contains the following article, which is interesting, as showing the cost of high speed—

"*Old and New Atlantic Steamers.*—In June of last year we gave some interesting particulars of the relative performance of the **Alaska**, **Servia**, and **Britannic**, showing the results given by each steamer after crossing the Atlantic almost in company with each other.

"During the present month the **Britannic** has again been crossing about the same time with the two latest additions to the Atlantic fleets, namely, the **Oregon** and **America**, and gives us another opportunity of analyzing the relative merits of the 'Old and New Atlantic Steamers.'

"The **Oregon** and **America** both left New York on Wednesday, the 8th of October, and both arrived at Queenstown on the 15th following, the **Oregon** running a distance of 2819 knots, occupying 6 days, 12 hours, 37 minutes, which gives a speed of 18·01 knots per hour; the **America** running a distance of 2777 knots, occupying 6 days, 17 hours, 43 minutes, a speed of 17·14 knots; the **Britannic** left New York on October 11th, and arrived at Queenstown on October 19th, after running a distance of

2852 knots in 7 days, 12 hours, 17 minutes, which gives a mean average speed of 15·85 knots, thus occupying, say, one day longer than the **Oregon**, and about 18½ hours longer than the **America**.

"By these figures it will be seen that in a period of ten years a gain of one day has been obtained in crossing the Atlantic; and assuming that the consumption of each ship was, respectively, 265, 185, and 100 tons per day, to gain this one day the **Oregon** burned about 1656 tons, and the **America** about 1174 tons on the passage home, whereas the **Britannic** burned only 750 tons.

"If we then consider that, in the case of the steamer **Oregon**, it was necessary to burn 906 tons to gain 24 hours, and in the case of the America, 424 tons to gain 18½ hours on the **Britannic**, it may well be asked, 'Do the New steamers yield the same efficiency as the Old?'

"Looking at the wonderful performances of the **Britannic**, and her sister ship the **Germanic**, during the past ten years, it seems as if they yet could be made to compare with the newer rivals in speed by increasing the power of their machinery in but a moderate degree, as it is plainly evident that their superior model serves them in good stead; and, considering that the **Britannic's** last homeward passage is (if we are not mistaken) the fastest she ever made, the strength of hull would be amply sufficient to allow of the increased power being supplied, which the extensive use of steel would permit, to suit the existing portions of the ship.

"When, then (as we stated in our former article), the boilers of these steamers require renewal, it should, in our opinion, be seriously weighed, whether or not it is advisable to replace the existing machinery (excellent though it be) with either triple expansion or ordinary compound engines of such power as to increase the speed to 18 knots.

"In order to place more clearly before our readers how much it requires to obtain so little, the following table showing the relative horse-powers, etc., will be of interest—

	Fastest passage. d. h. m.	I.H.P.	Consumption.	Tonnage.	Speed.
Oregon .	6 12 27	13,000	265 tons	7,250	18 knots.
America .	6 17 43	9,800	185 „	5,530	17·1 „
Britannic	7 12 17	4,900	100 „	5,004	15·8 „

Again, on September 6th, 1880, the *Liverpool Journal of Commerce* contained the following further history of their doings in an article headed—

"AN UNPRECEDENTED RECORD—THE **Britannic**.

"We have on previous occasions drawn attention to the singular performances of many of the White Star Company's vessels. We say 'singular' because the results attained are absolutely without parallel in the history of steam shipping. We could mention many fine ocean steamers belonging to the various companies which still do good work after some ten or fifteen years' service, but it is always the case that such vessels are relegated to the less important routes owing to their inability to maintain the requisite speed. In fact, taking the average experience with ocean steamers, it is found that in ten or twelve years' time they become obsolete, and it is then usually a question of re-engineering and re-boilering them, or selling them out of the fleet. Looked at, then, in the light of the average steamship capability, the record of some of the earlier White Star Company's vessels is simply marvellous, and, as we say, altogether without precedent. We have before us the log of the White Star mail steamer **Britannic**, which arrived in the Mersey on Thursday evening, September 4th, from New York. She left New York at 9.35 p.m. (Greenwich mean time) on Wednesday in last week, and arrived at Queenstown at 4.30 a.m. on Thursday, the 4th instant, thus completing her 318th Transatlantic passage in 7 days, 6 hours, 55 minutes, the fastest time she has yet made. The following is her log—

August	28	. . 292	knots.	
„	29	. . 372	„	
„	30	. . 377	„	
„	31	. . 370	„	
Sept.	1	. . 376	„	
„	2	. . 377	„	
„	3	. . 387	„	
—	—	. . 261	„	to Queenstown.
Total		. 2,812	knots,	

or an average speed of 16·08 knots per hour. Fine weather prevailed during the passage. The **Britannic's** previous best performance was in March 1888, when she crossed from Sandy Hook to Queenstown in 7 days, 9 hours, 30 minutes, which was regarded as sufficiently remarkable. But when it is remembered that this high speed, averaging over 16 knots per hour throughout, or nearly 19 statute miles, is obtained in a ship of over sixteen years old, with her original compound engines and boilers, on a small coal consumption, and with her large carrying capacity, it will be seen that the **Britannic** has been so constructed as to give results unattainable with the fastest ships of the present day, and actually increases in speed as she grows older, reversing the usual experience. It is worthy of mention that in ten voyages performed during 1888 the **Britannic** averaged 7 days, 15 hours, 57 minutes, whilst her sister ship, the **Germanic**, during 1889 made thirteen voyages averaging 7 days, 15 hours, 21 minutes, showing a wonderful uniformity in the speed of these twin vessels. The **Britannic** and **Germanic** were built in 1874, by Messrs. Harland and Wolff, Belfast, and engined by Messrs. Maudslay, Sons, and Field, London, the engines being a remarkably fine set of tandem compounds. The question may be asked, To what do we attribute the magnificent performances of these vessels? We can only say that, in our opinion, a very great deal is to be credited to the shape of the hull. When many of our great liners are in dry dock we make it a point to inspect them, and compare the different lines.

Any one who has done this, and compared the **Britannic** with other crack boats, cannot have failed to notice very great differences. The extreme fineness of entrance, the absence of forefoot, the long and full midship section, and the graceful run aft are features of these boats more pronounced than in most others. Again, a glance at the proportions of these boats and the results achieved prove the soundness of Scott-Russell's theory that to obtain speed we must have great relative length. These points in the design of the hull have been so carefully and judiciously considered by the talented designer of the White Star boats, Sir E. J. Harland, with the result that they are among the most economical as regards coal consumption of any vessels on the Atlantic. Of course, we can put, as is sometimes done, unlimited power into a vessel and drive her. This is, however, not scientific, and therefore not commercially successful. In the machinery of these vessels there is nothing very special, except that at the date of its construction it represented the best marine practice. Those who believe in 'good iron' for ships and engines can certainly point to the **Germanic** and **Britannic** as an instance in point. Another very important factor has been the splendid workmanship put into these vessels, and another equally important factor is that the owners have a name for keeping their vessels in the highest state of efficiency, no expense being spared to this end. Lastly, Messrs. Ismay, Imrie and Co., entrust their splendid vessels only to the very best men, as captains, engineers, and officers, that they can procure. Nothing except faithful service rendered, work honestly and carefully performed, could achieve these astonishing results. The company pay the highest wages, and so obtain the best service."[1]

[1] Since this was written both these vessels have eclipsed their best performances. The **Britannic** in August 1891, when nearly eighteen years old, having made the passage, New York to Queenstown, in 7 days, 6 hours, 52 minutes, and the **Germanic**, seventeen years old, in the same month (August 1891), made the same passage in 7 days, 7 hours, 37 minutes.

It is to the White Star Line that the public are in a great measure indebted for the rapid advance in marine architecture and engineering during the last twenty years, owing to the energetic and judicious way in which it has brought out and developed the improvements now so extensively adopted.

Amongst the most important of these the following may be mentioned, namely—

Introduction of the improved relative proportions of length, breadth, and depth.

Placing of saloon and passenger accommodation amidships.

Adoption of electric bells on board ship.

Providing separate chairs in saloon for each individual.

Self-acting, water-tight doors.

Improved bulkhead division, and carrying them up to proper height.

Introduction of bridal chambers, as in this age of rapid transit, a trip across the Atlantic is not too extensive for a honeymoon.

Adoption of Maury's Lane routes.

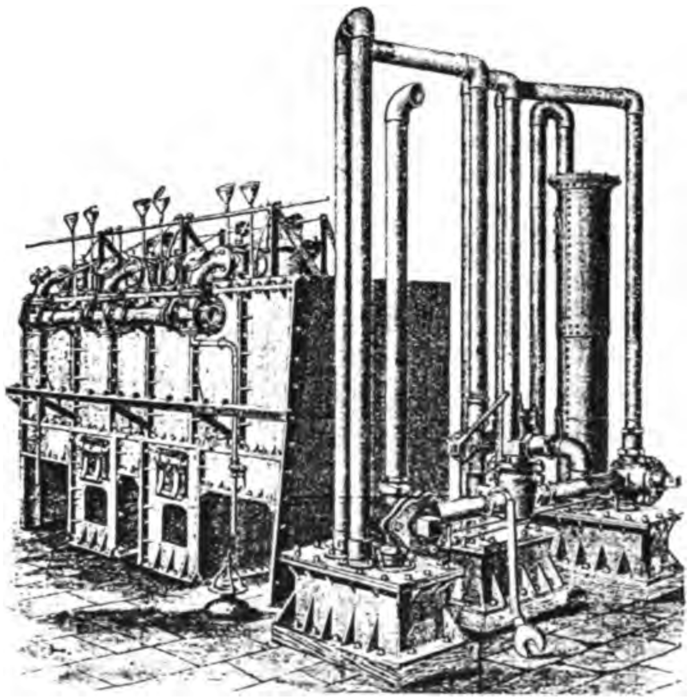
Overlapping twin screw propellers.

Better system of lighting throughout by the replacing of the candle system in 1872-3 with superior mineral sperm oil lamps, followed afterwards by an elaborate and commendable attempt to adopt gas lighting.

The system of gas supply was somewhat like that now so widely adopted for the lighting of railway carriages, the gas being made from vaporized oil, by an ingenious

apparatus, which was placed just off the engine-room, and occupied about 1600 cubic feet of space.

This was designed and manufactured by Messrs. Porter



GASWORKS FITTED ON WHITE STAR LINE CELTIC, 1873.

and Co., of Lincoln, the first steamer fitted being the **Adriatic** in 1872, followed afterwards by the **Celtic** in 1873. The general effect in the saloon, where there were thirty jets, and in the emigrant accommodation when the whole was lit up, was much admired, being a marked

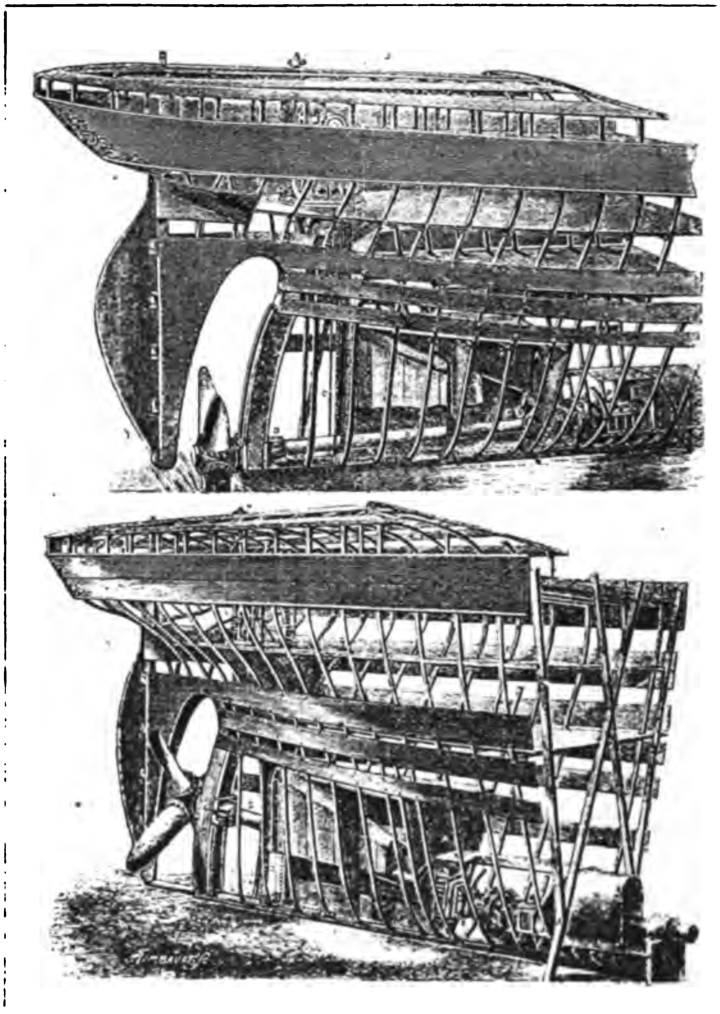
contrast to the candles then customary. Considerable trouble was, however, given by failure of the pipes through the working of the ship at sea, and other causes, allowing leakage, and it was eventually abandoned for the mineral oil lamps.

Another attempt to surmount the trials of the "rolling forties," was the adoption of oscillating state-rooms and berths to counteract the motion in a sea-way, but this, like the more colossal experiment afterwards made on the **Bessemer**, was abandoned, being utterly ineffectual.[1]

An important effort to advance further afield in marine engineering was made by the adoption on the **Britannic** of a system of raising and lowering the propeller, so that the shaft could be lowered when in deep water till it almost touched the keel, and so allow the propeller to work in more solid water, and be less liable to race when pitching in a heavy sea. To attain this object very great alterations had to be made in the arrangement of the stern, so as to allow of a hollow recess in the hull in which the after length of the shafting could move up and down, swivelling from a universal joint, connecting with the tunnel shafting.

The machinery was so placed in the ship as to rake very much aft, in order to have the whole of the shafting in a straight line when the propeller was working in its lowered position at sea. After a trial extending over some months, the results were not found so satisfactory as had

[1] The oscillating saloon of the **Bessemer** was 70 feet long by 30 feet broad and 20 feet high. The vessel cost £200,000, but was a total failure.



STERN OF BRITANNIC, AS ORIGINALLY FITTED WITH LOWERING PROPELLER, 1874.

been hoped, or as the working of smaller vessels had previously indicated, so that it was done away with at considerable expense.

Like some of the other large Transatlantic lines the White Star has not confined itself to the one service, but has widened its connections to such an extent that the well-known cream-coloured funnel and graceful hull may be found floating on all waters of the "great sea." In 1875 an important service was formed on the Pacific between San Francisco and China and Japan, on which service the **Oceanic** still continues one of the clippers of the seas, in conjunction with the **Belgic** and **Gaelic**, modern vessels built to replace others of the same name, sold out of the service as being too small.

NEW ZEALAND LINE.—Another important extension of the ocean traffic, begun in 1883, was the direct Royal Mail Service to New Zealand, which fine vessels, such as the **Ionic**, **Doric**, and **Coptic**, carry on in conjunction with the Shaw, Saville, and Albion Line. This now important service was first inaugurated by the New Zealand Shipping Company in 1883. The pioneer steamers, which were under the author's superintendence, were the **British King** and **British Queen**, steel vessels chartered from the British Shipowners' Company, of Liverpool. These vessels, by Messrs. Harland and Wolff, were 410½ feet long, 39 feet broad, 29 feet deep, and of 3412 tons, each having four-cylinder compound tandem engines by Messrs. Jack and Co., of Liverpool, with two high-pressure cylinders, each 28 inches diameter, and two low-pressure, each 60 inches diameter, the stroke being 4½ feet. Steam at 90

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R.M.T.S. TEUTONIC (1889) AND MAJESTIC (1890). WHITE STAR LINE.

lbs. pressure was generated in three boilers having eighteen furnaces, the speed being 12 knots on a consumption of 38 tons per day.

After some years, during which no high speed vessels were built, although several ordinary passenger and cargo boats for other trades were brought out, another important step was taken by the White Star Line which had been long premeditated, namely the building of steamers to keep pace on the Express Transatlantic Passenger Service.

Satisfactory negotiations having been concluded with the British Admiralty, who, profiting by experience, were now anxious to form a real connection between the Royal Navy and the "great fleet messengers of the Mersey," on the basis of an arrangement put forth by Mr. Ismay, the order was placed with Messrs. Harland and Wolff to build the two famous steel vessels **Teutonic** and **Majestic**, which were 566 feet long, 57¾ feet broad, 39½ feet deep, and of 9686 tons. These stately ships, although of the same substantial construction and excellent arrangements as the first vessels brought out by this Company, present a different external appearance. The four masts are replaced with what may be termed three flag-poles, the partial abandonment of sail power initiated by the Inman and International Line being carried still further, and the two funnels are spaced so far apart as to allow the saloon being placed between them, the great length of the vessel allowing this to be done uniformly with the masts.

Beyond the fact that the hulls are divided into small compartments by both transverse and fore and aft bulkheads, and that the saloon accommodation is of the most

luxurious kind, having extensive state- and retiring-rooms *en suite* and of considerable height, the interior calls for no comment, but attention may be drawn to the ingenious arrangements of the first-class accommodation, whereby each state-room is fitted with only one berth, so that, when preferred, a passenger can procure the privilege of having a room to himself.

The propelling power, although twin-screw, possesses the novelty in this trade of having the propellers overlapping a few feet instead of being a slight distance out on each side from the hull; this system, although apparently novel, has long been in use elsewhere, and has been used also by Messrs. Harland and Wolff in some cross-channel vessels.

Early in 1891 another step forward was taken by this line in increasing their fleet of cargo steamers, such as the **Cufic** and **Runic**, by the addition of the **Nomadic**, **Tauric**, and **Bovic**, improved forms of cargo vessels specially adapted for live cattle. These also have the twin screws which have proved so successful on the express boats, and seem to have become the prototype of the future cattle fleets of Great Britain, as their exceptionally good ventilation and general arrangements render them admirably adapted for this class of trade.

It may be interesting to mention that the now extensive trade of carrying live cattle across the Atlantic and other oceans was commenced in July 1874; the first steamer to bring cattle to Liverpool from the continent of North America was the **European**, belonging to Messrs. H. N. Hughes and Nephew, with 373 head of cattle, out of which three were lost; the next vessel, the **San Marcos**, in July

1875, with 276 head, all for the firm of George Roddick. The dead meat trade by refrigeration commenced on the Guion Line's **Wyoming** in October 1875, a few small lots having previously been successfully carried in 1874 on the White Star liners **Celtic** and **Britannic.**

Unlike the other Transatlantic lines the proprietary of the White Star has undergone no change, the well-known and respected names of Ismay, Imrie and Co. (since joined by Mr. W. S. Graves in 1881, and the two sons of the senior partner, Mr. Ismay, in 1891) still continuing to steer its course in the same brilliant and enterprising manner as from the commencement.

The following important correspondence, condensed from the *Liverpool Daily Post*, of March 18th, 1887, explains the arrangement above referred to with H.M. Government—

"THE GOVERNMENT AND ARMED CRUISERS.

"A Parliamentary paper just issued contains copies of correspondence respecting the subvention of merchant steamers for State purposes. The paper opens with a letter, dated the 31st January, from Mr. Ismay (of Messrs. Ismay, Imrie and Co., White Star Line), giving the terms on which they were prepared to carry out the scheme for the subvention by the Admiralty of mercantile vessels specially built for service as armed cruisers. Mr. Ismay says—

"The Oceanic Steamship Company

"1. Undertake to hold at the disposition of the Government, for purchase or hire, at the option of the Admiralty, to be exercised from time to time during the continuance of the agreement, the following vessels, viz.:—**Britannic,** £130,000; **Germanic,** £130,000; **Adriatic,** £100,000; and **Celtic,** £100,000.[1]

[1] The **Celtic** has now been withdrawn, having been sold to the Thingvalla Line in 1893, and renamed by them the **Amaraka.**

"2. In the event of purchase, the foregoing prices are to be held as the values of the vessels on the 1st January, 1887, plus 10 per cent. for compulsory sale, less an abatement of 6 per cent. per annum on the depreciated annual value for the period that may elapse between the 1st January, 1887, and the date of purchase by the Government. In such case the Company shall be entitled to remove from the ship or ships the plated ware, cutlery, crystal, earthenware, blankets, counterpanes, and linens, which articles are not to be considered as part of the equipment of the ships; such proportionate quantities, however, as may be necessary for the number of officers and warrant-officers that would form part of the ship's complement, if used as an armed cruiser, to be left on board free of charge.

"3. In the event of charter by the Admiralty the rate of hire of the before-named vessels, all or any, to be at the rate of 20*s.* per gross registered ton per month, the owner providing the crew, or at the rate of 15*s.* per gross registered ton per month, the Admiralty finding the crew, all risks of capture and of hostilities being assumed by the Admiralty.

"The offer of the Cunard Line is contained in a letter by Mr. John Burns, dated 8th February. He offered for sale or hire the following vessels: **Etruria**, of 7,718 gross tons, value £310,000; **Umbria**, 7,718, £301,000; **Aurania**, 7,269, £240,000; **Servia**, 7,392, £193,000; **Gallia**, 4,809, £102,000.

"The terms of the subvention and purchase are similar to those agreed to by the White Star Line, but for the charter of the three first vessels the demand is 20*s.* per ton register per month without crew, and the other two 15*s.* per ton per month without crew. In the event of the Company determining to build new ships for the mail service, they undertake to submit the plans to the Admiralty, with a view to their being constructed in a manner best suited to the purpose of armed cruisers."

In 1893 the **Etruria** and **Umbria** were taken off the list, and the **Campania** and **Lucania** substituted, the **Aurania** having been removed from the list some time previously.

CHAPTER VI.

DOMINION, AMERICAN, STATE, WARREN, WILSON, AND BEAVER LINES.

FOLLOWING the example of the White Star Line, another of the existing lines, the Dominion, commenced in 1872 a service between Liverpool, Quebec, and Montreal; this was an offshoot of the Liverpool and Mississippi Steamship Company trading between Liverpool and New Orleans, and has continued in the service ever since, carrying the Royal Mails in conjunction with the Allan Line. Since the commencement many fine vessels have been added to the Dominion fleet, the last being the **Labrador,** a steel single-screw steamer built and engined at Belfast by Messrs. Harland and Wolff, which was put in the service in 1891, and soon afterwards made the fastest passages outward and homeward on the Canadian routes.

Besides the passenger service, the Dominion Line also carries on an extensive cargo and live cattle trade to both Liverpool and Bristol. Since its foundation the management has been in the hands of the well-known firm of Messrs. Flinn, Main, and Montgomery, no change having taken place.

From the failure of the Collins Line and others noted, down to the year 1871—with the exception of an attempt in 1866, when a Boston firm commenced trading to Liverpool with wooden screw-steamers, named the **Erie**, **Ontario**, **Worcester**, &c., which only made a few trips—no efforts were made by the United States to establish an American Transatlantic line, but in that year steps were taken in Philadelphia, and an order placed with Messrs. Cramp, of that city, to build four iron screw-steamers each 343 feet long, 43 feet broad, 34½ feet deep, and of 3119 tons, with vertical two-crank compound engines, having cylinders 57 and 90 inches diameter, with a stroke of 4 feet, and boiler pressure of 60 lbs.

These vessels, named the **Ohio**, **Indiana**, **Illinois**, and **Pennsylvania**, were fitted with first-class passenger accommodation, and, in conjunction with other English steamers named **Lord Gough**, **British Prince**, etc., have carried on the American Line between Liverpool and Philadelphia since its commencement with the **Pennsylvania** early in 1873.

After carrying on this service under the original promoters for some years, these four steamers were taken over by the International or Red Star Line (already noted) in 1884, who had the saloon accommodation removed, and employed them in the more profitable emigrant and cargo service in which they are still engaged.

It is interesting to note that it was on one of these steamers the now well-known system of Howden forced draught was introduced in the Atlantic trade, this being fitted to the steamship **Ohio** in the year 1887, when she

Amer.
1871

had new triple engines fitted, and new boilers, which resulted in a great addition to her earning space. These four steamers, **Ohio**, **Indiana**, **Illinois**, and **Pennsylvania**, are the only regular liners on the Atlantic trade which fly the American flag, owing to the United States law which formerly prohibited any vessel to fly it unless actually constructed in the country. But as already noted (page 53), this law was recently modified (in 1892) to allow of the two steamers, **New York** and **Paris**, being transferred to the American flag to form the nucleus of an American Atlantic Line, trading between Southampton and New York.

In 1873 a venture which has since struggled to keep a place upon the Atlantic highway was formed in Glasgow to trade from that port—and occasionally Liverpool—to New York, under the name of the State Line. This continued to ply, calling at Larne (Ireland), until early in the year 1891, when it collapsed, the steamers passing into the hands of the Allan Line to swell their already enormous fleet.

In the same year also, 1873, the South Wales Atlantic Steamship Company was formed to run from Cardiff to New York, but only lasted two years, notwithstanding that they had no dock dues to pay at Cardiff and were supplied with coal gratuitously by the Marquis of Bute, who was one of the largest shareholders in the line. The two steamers were named **Glamorgan** and **Pembroke**, and were fitted up in superior style, the former having been lighted with Allan's patent gas apparatus, which, like the vessels, was unsuccessful.

The next expansion of this great trade was made in

1874 from Bristol, the port which first created and carried it on. This was made by a company called after the one which originated the enterprise, namely the Great Western, which now carries on a moderate freight and cattle service.

The year 1875 also saw the birth of another Liverpool line of steamers named the Warren Line, which commenced a steam service to Boston by the purchase of the Guion Line pioneers, **Manhattan** and **Minnesota**. These they had fitted with new compound engines, and then placed them on the station for their freight and cattle service early in the year noted, and since then have gradually expanded and added some of the finest freight and cattle steamers afloat to their line. Under the flag of the Warren Line the vessels of the North Atlantic Steam Navigation Company and others also sail, and it is interesting to note that they have in their service one of the oldest, if not the oldest, vessel on the Atlantic, namely, the **Palestine**, built by Steele and Co., of Greenock, in 1855.

In February of the same year, 1875, another huge trading fleet appeared on the Atlantic, sent forth by the great shipping firm of Wilson, whose already extensive trade from Hull enabled them to command a profitable trade from almost any part of the world. In 1884 they introduced to the Atlantic trade the triple expansion engines on their steamship **Martello**, a vessel 370 feet long, 43 feet broad, 28 feet deep, and of 3709 tons, with triple engine having cylinders 31, 50, and 82 inches diameter, and 4 feet 9 inches stroke. This service still continues, having been largely increased by a London

Warren, 1875

connection which was formed, in conjunction with another line, in 1886, to be noticed later.

Another of the existing regular lines, the Beaver, or, more correctly speaking, the Canada Shipping Company, Limited, also commenced in 1875 to change from their fine fleet of iron sailing clippers to the steam service, and had three fine iron steamers named the **Lake Nepigon**, **Lake Champlain**, and **Lake Megantic**, built for them on the Clyde, since when they have carried on a regular service to Canada in the summer and New York in the winter, and considerably increased their fleet.

Beaver
1875

CHAPTER VII.

LEYLAND, JOHNSTON, AND LONDON LINES.

NOTWITHSTANDING the numerous lines already noted, another came upon the scene in 1876 to compete with the Cunard Company for a share of the Boston trade; this important Company, now known as the Leyland Line, commenced on this service in 1876, but had long been engaged in the Mediterranean trade from Liverpool under the esteemed firm of Bibby, which had retired from the management some years before. To carry on this service the six largest ships of the then existing fleet were placed upon the route, and as they were, so to speak, prototypes of the White Star boats, being built prior to them by the same firm of builders, they were successful, and were soon afterwards fitted with larger compound engines and generally altered to suit them for the wild Atlantic. Since its inauguration the Leyland Line has been most successful, and of late has added such fine vessels as the **Bostonian**, **Lancastrian**, **Georgian**, and others, built by Messrs. Harland and Wolff, to maintain it up to the standard necessary for a modern Transatlantic freight line. Early in 1893, owing to the death of the principal, the line was reorganized as a public limited company.

Leyland 1876

In the year 1880 the only regular line from Liverpool to Baltimore was commenced by the firm of Messrs. W. Johnston and Co., who were already extensively engaged in the steamship trade to the Danube and other ports. The service is now carried on very extensively with some fine cattle and freight steamers such as the **Queensmore, Rossmore, Barrowmore, Sedgemore,** and others. Another service from London to Baltimore has also been carried on since early in 1890 with fine steamers of the same class.

In addition to these lines, there are now very many other occasional vessels engaged, such as the **St. Ronans** and **Borderer,** trading to and from the various ports of the United States and Canada, which countries may well be termed the great granaries of modern times owing to the enormous supplies they send to the mother country.

Although the great city on the Mersey still controls almost the whole of the passenger and by far the greater bulk of the freight service of this vast "coming and going" of modern commerce, a considerable number of other freight lines now find location on the Thames, in order to supply direct the teeming mass of humanity centring in the great emporium of the world, London. One of the principal of these is that now known as the Wilson-Hill Line, which, as already noticed, now carries on the service formerly known as the Monarch Line. This once noted line was commenced in 1881 under the official title of the Exchange Shipping Company, Limited, by Messrs. Patton, Vickers and Co., with a view of carrying on direct from London to New York a regular saloon and emigrant passenger service combined with cargo,

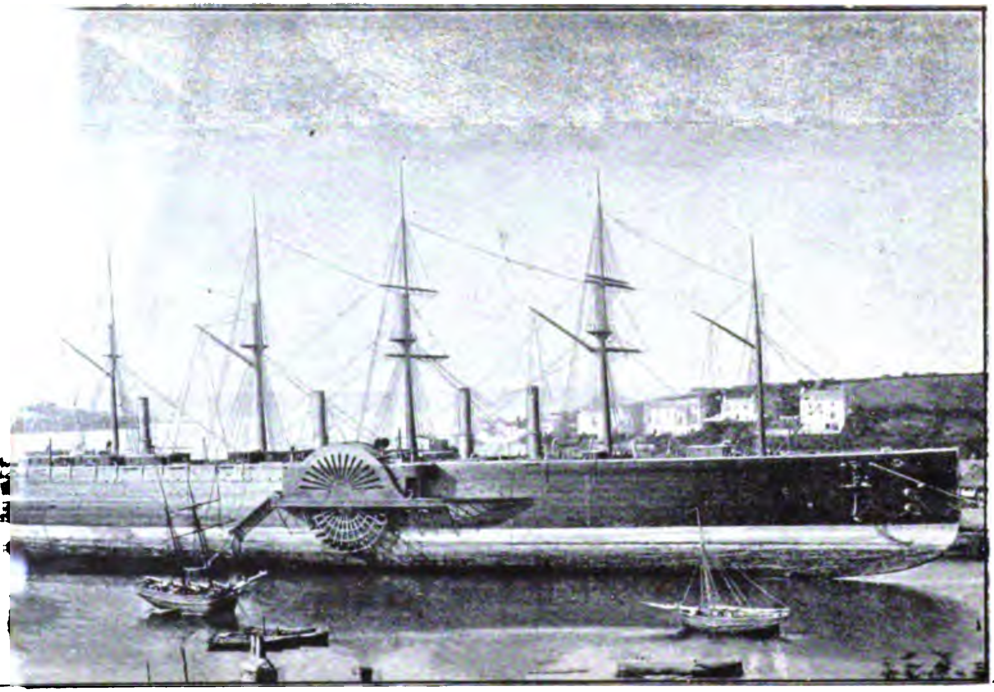
and was commenced with the **Assyrian Monarch** and other steamers built by the Earle Shipbuilding Company, in Hull, followed afterwards by others built on the Clyde. During the early portion of its career a fairly successful business was carried on, but this gradually fell away, and in 1887 the line collapsed, and the steamers, after being laid up in London for some time, were taken over by the Wilson Line of Hull, and the Allan Line of Glasgow, represented by the line then trading from London, called the Hill or Twin Screw Line.

This latter line (Twin Screw) came into notice in the year 1881 by bringing forward the first twin-screw propelled steamer in the Transatlantic trade. This vessel was named the **Notting Hill**, and was built of steel on the Clyde, her dimensions being 420 feet long by 45 feet broad, 26½ feet deep, and of 3920 tons, and was followed afterwards by others of similar dimensions and construction.

Although fitted with limited passenger accommodation, they were not designed for what is now generally known as the Express Transatlantic Service—their speed only averaging about 12 knots per hour.

The engines are of the compound tandem type, but having only one crank-shaft and set of cylinders for each (port and starboard) engine, the diameter of each high-pressure being 32½ inches, and of the low-pressure 76 inches, with a stroke of 4 feet.

These vessels now carry on a regular service from London to New York in the live cattle and freight trade, in conjunction with the vessels of the old Monarch Line, as previously mentioned.



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GREAT EASTERN (1858).

One set of boilers and one funnel, between fourth and fifth masts, were removed for cable-laying purposes.

In addition to the Wilson-Hill, National, and Johnston Lines, already noted as trading from London, extensive services are also carried on by the Furness Line to Halifax and Boston, and the Atlantic Transport to Baltimore, Philadelphia, Boston, etc., *viâ* Swansea, commenced in 1886.

Another line commenced in recent years in the live cattle and freight service is the Donaldson, from Glasgow to Canadian ports, which commenced with the steamship **Colina** in May 1887 and still continues.

It will perhaps be of interest to give a brief final notice of the once famed **Great Eastern**. Her dimensions were 679½ feet long, 83 feet broad, 48 feet deep, and 18,915 tons, with oscilliating paddle-engines, having four cylinders each 74 inches diameter, and stroke of 14½ feet, and horizontal screw engines, with four cylinders, each 84 inches diameter, and 4 feet stroke, the boiler pressure being 30 lbs., generated in ten boilers, having a hundred furnaces fired athwartships. The career of this colossal structure, commencing with her launch in 1858, was singularly unfortunate, as with the exception of the successful laying of the first Atlantic cable, and a few others, she has never once been a commercial success. As if to add still further to her misfortunes, the last years of her existence saw this once wonderful example of the "much-belauded pet of man's constructive skill" lowered to the level of an advertising medium, and then to be the bugbear of the ports of the kingdom, one port even going so far as to ask Parliament to grant them powers to prevent her floating on the tranquil waters within their precincts.

After a year or two of this degraded existence, she again underwent one of the periodic sales which had occurred almost annually throughout her career, but for the last time, as she was purchased by a firm of ship-brokers for £16,000, and was eventually broken up at New Ferry, on the banks of the Mersey, almost in the same year (1890) that the **Great Britain** ended her career at the Falkland Islands, representing with the broad gauge on the railway, now also abolished, the last of the costly and bitter memories of the engineer Brunel, who, unfortunately for many, had more influence with great capitalists than other far more capable and less fanciful engineers.

CHAPTER VIII.

CONTINENTAL LINES.

Turning now to the continent of Europe, we find many steamship companies competing for shares of the traffic ever flowing to and fro on the greatest highway of commerce the world has ever known, and which may well be termed the "Nursery of the Steamship," owing to the great achievements in naval architecture and marine engineering which from time to time it has brought forth.

Amongst the largest and most important of these is the well-known Hamburg-American Line, trading from Hamburg and Cuxhaven to New York, calling at Southampton. This powerful company, like the English lines, first commenced the trade with sailing ships in 1847, and gradually developed into steam, their first steamer being the **Borussia**, an iron screw-steamer, built and engined by Messrs. Caird, of Greenock, in 1855. Her dimensions were 317¾ feet long, 40 feet broad, 28 feet deep, and of 2349 tons; the engines were overhead oscillating geared, with cylinders each 67 inches diameter, and stroke of 6 feet. This vessel, the pioneer, started on her first voyage on June 1st, 1856, and was followed by a sister ship named the **Hammonia**, which two steamers kept up the service,

in conjunction with the sailing vessels, until the year 1860, when the latter were disposed of and more steamers added. Since then the line, having, in April 1875, absorbed the opposition Hamburg company known as the Eagle Line, has developed into an extensive concern, sending its steamers east and west, and gradually expanding its Transatlantic connection, until at the present time it stands at the head of the continental lines, and possesses, besides an ordinary moderate speed passenger service to New York, an express service almost equal to the Liverpool lines, its modern twin-screw steel boats being of the finest type, with the most advanced arrangements for comfort.

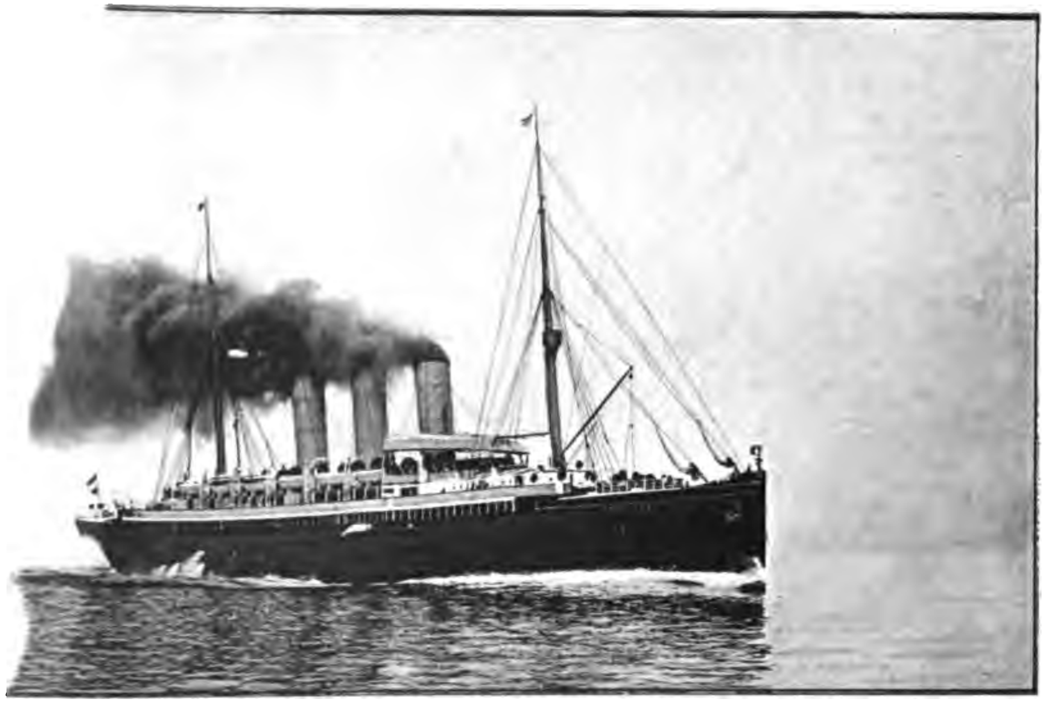
Of these the **Columbia** and **Normannia** have been built on the Mersey and the Clyde respectively, and the **Augusta, Victoria**, and the **Fürst Bismarck** by the Vulcan Company, at Stettin. The relative sizes of the ships and engines, which are triple expansions of the latest type, are as follows—

Columbia, 463½ feet long, 55½ feet broad, 35½ feet deep, and of 7363 tons. Triple engines, cylinders 41, 66, 101 inches diameter, with 5½ feet stroke.

Augusta Victoria, 459 feet long, 55¾ feet broad, 38 feet deep, and of 7661 tons. Triple engines, cylinders 41, 67, 106 inches diameter, with 5¼ feet stroke.

Normannia, 500 feet long, 57½ feet broad, 38 feet deep, and of 8250 tons. Triple engines, cylinders 40, 67, and 106 inches, with 5½ feet stroke.

Fürst Bismarck, 502 feet long, 57½ feet broad, 38 feet deep, and of 8874 tons. Triple engines, cylinders 43, 67, 106¼ inches, with 5¼ feet stroke.



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NORMANNIA (1890). HAMBURG-AMERICAN LINE.

Like the old Inman and International Line vessels this fine quartette have adopted the three funnels, and abandoned the use of sail power, and make the passages across between Southampton and New York under seven days, taking about eight days to and from Hamburg.

The other important German line is that known as the Norddeutscher Lloyd from Bremen, which was founded in 1856 by a Bremen citizen, Herr H. H. Meier, who succeeded in amalgamating the various steamship companies, coasting and otherwise, then existing, and forming out of them this great company. It was practically constructed in February 1857, and commenced the Transatlantic service in June 1858, with the screw-steamer **Bremen**, 318 feet long, 40 feet broad, 26 feet deep, and of 2674 tons, with inverted direct-acting engines, having cylinders 90 inches diameter, and 3½ feet stroke, indicating 2500 horse-power. She was built by Caird and Co., of Greenock, together with three others, named the **New York**, **Hudson**, and **Weser**.

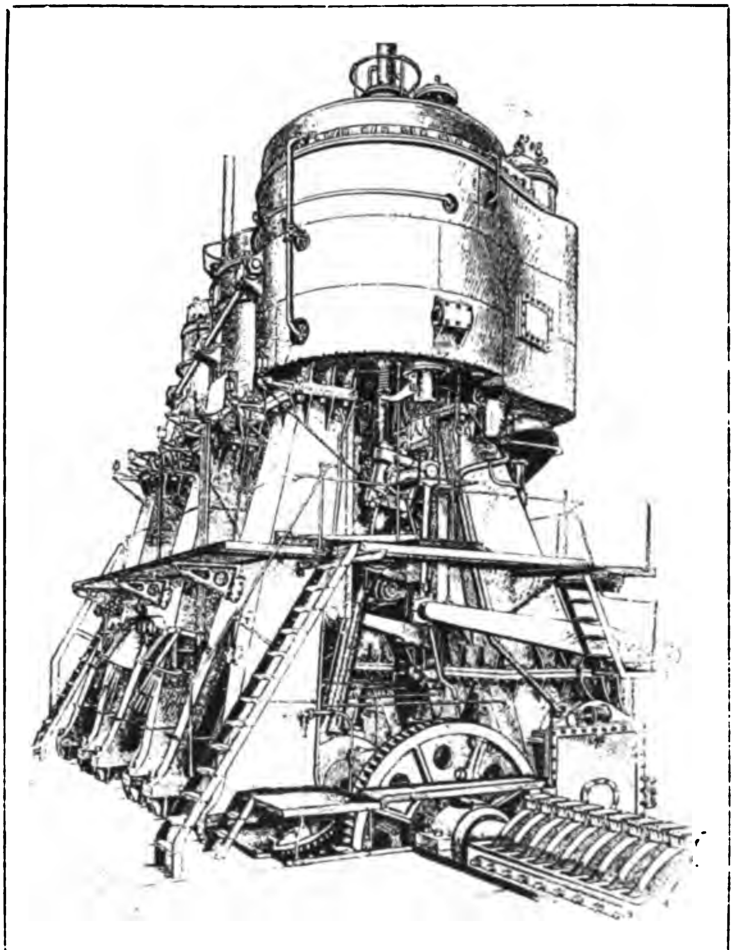
Since this event a regular trade has been carried on, and many vessels added to the Norddeutscher fleet from time to time; in 1862 and 1863 the **Hansa** and **America**, followed by the **Hermann**, **Deutschland**, and **Union**, all built by Caird and Co.

In 1868 a weekly service was commenced from Bremen to Baltimore, and since then extensive offshoots have been created to the most distant parts of the globe.

In 1881, under the spirited management of Herr Lohmann, the then managing director, new 17½ knots express steamers, named the **Elbe**, **Werra**, and **Fulda**, each

438 feet long, 48 feet broad, 34·6 feet deep, and of 5400 tons, built by Messrs. Elder and Co., were placed upon the New York service, and were followed afterwards by the 18 knot **Aller**, **Trave**, and **Saale**, in 1885 and 1886, which were single screws, and had the first triple expansion engines in the Express Service (although not the first on the Atlantic, as already noted), the diameter of cylinders being 44, 70, and 108 inches respectively, with a stroke of 6 feet, and of 8200 indicated horse-power. Since then has appeared the **Lahn**, 19 knots, of slightly larger dimensions, from the Fairfield Shipbuilding Company, having triple engines with two high-pressure cylinders, each 32½ inches, one intermediate, 68 inches diameter, and two low-pressure, each 85 inches, with stroke of 6 feet, and indicating 9500 horse-power; also in 1890 and 1891, from the Vulcan Shipyard at Stettin, the **Spree** and **Havel**, two fine vessels, 463 feet long, 52 feet broad, 34 feet deep, and of 6963 tons, with triple engines of slightly larger power.

Owing to the gradual improvement of these fine vessels during the past decade, it will be noticed there is no great gap in their increasing speed, so that the service is carried out with express boats, which make the passages to and from New York in fairly equal time. The vessels of the North German Line maintain a weekly service to New York, leaving Bremen and New York every Wednesday and Saturday, and calling at Southampton; also a weekly service to Baltimore, leaving Bremen and Baltimore each Wednesday. To enable them to carry on this great trade and the other branches, the Company own a fleet of about



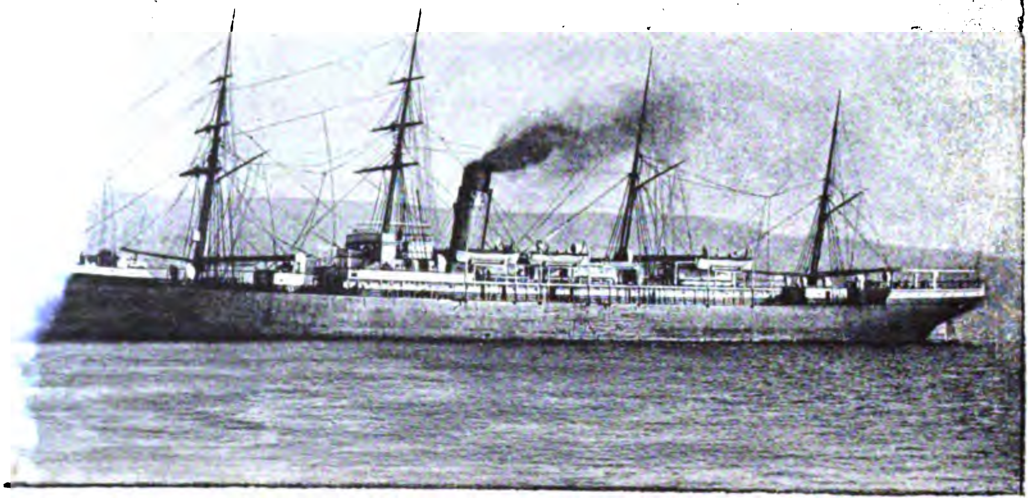
ENGINES OF THE ALLER.

forty steamers over 1000 tons each, besides numerous smaller craft, and also possess their own graving and other docks, together with extensive works for the overhaul and maintenance of their fleet.

One of the principal lines doing an extensive business from Europe direct is that officially termed the Société Anonyme Belge-Américaine, better known as the Red Star Line, from Antwerp. This now extensive service was commenced by the iron steamship **Vaterland,** 320½ feet long, 38½ feet broad, 31 feet deep, and of 2748 tons, with two-crank compound engines, having cylinders 40 inches and 80 inches diameter, and stroke of 3½ feet. She sailed from Antwerp on January 19th, 1873, for Philadelphia, and was followed afterwards by the **Nederland** and **Switzerland** in 1873 and 1874.

It is interesting to note that these vessels, which were built and engined by Messrs. Palmer, of Jarrow, were the first ever built to carry petroleum in bulk, in which an extensive trade to Antwerp was then commencing. As, however, the passenger trade was also carried on by these vessels, the carriage of petroleum, owing to the restrictions of the supervising authorities, was not proceeded with.

Owing to the continued expansion of their trade, other vessels were soon added to the Red Star fleet, the **Belgenland** in 1878, and **Rhynland** in 1879, built by the Barrow Shipbuilding Company, and later by the **Zeeland, Waesland,** and **Pennland,** which under the respective names of the **Java, Russia,** and **Algeria,** were previously known in the Cunard fleet. Following them came two fine vessels,



R.M.S. FRIESLAND (1889). RED STAR LINE

To face page 101.

known as the **Westernland** and **Noordland**, from the yard of Messrs. Laird Brothers, Birkenhead, in 1883.

In 1889 the last addition was made to the fleet by Messrs. J. and G. Thomson, of Glasgow, who built a fine high speed single-screw steel steamer named the **Friesland**, 430 feet long, 51½ feet broad, 35 feet deep, and of 6800 tons, with triple expansion engines, having cylinders 35½, 56, 89 inches diameter, and 4½ feet stroke, and with a working pressure of 160 lbs.

With this fine fleet a regular weekly first-class passenger and emigrant service is carried on to New York, and a secondary one fortnightly to Philadelphia.[1]

Of the Transatlantic lines trading from France the most important is the Compagnie Générale Transatlantique, which commenced to run from Havre to New York in 1862 with English-built iron vessels, from the firms of Messrs. Napier and Sons, on the Clyde, and Messrs. Palmer, on the Tyne. The French company, like the other numerous lines, has gradually increased its fleet and expanded its services, and now possesses a magnificent fleet of steamers, the finest of which are vessels of large size and good speed, constructed some years ago to maintain a place amongst the other express lines to New York. One of these vessels, **La Normandie**, was built of iron at Barrow, in 1882, with engines having six cylinders, corresponding to those of the **City of Rome**; she was followed by **La**

[1] Owing to the formation of the new American Line (noticed on p. 53), of which this line is an integral part, new vessels are being built in Philadelphia, and the steamers are in future to make Southampton a port of call.

Bourgogne, **La Champagne**, and **La Bretagne**, the two latter being constructed at the Company's own works at St. Nazaire; they are each 495 feet long, 52 feet broad, 33½ feet deep, and of 6900 tons, with six-cylinder compound three-crank engines.

In addition to these four vessels another fine twin-screw steamer, named **La Touraine**, built at St. Nazaire, has been added in 1891, which is 520·3 feet by 56 feet broad and 34½ feet deep, but although a fast vessel she has not yet surpassed the speed of the German boats.

Other French lines trading in the cargo service are the Chargeurs Réunis, Compagnie Commerciale, from Havre, and the Compagnie Bordelaise, from Bordeaux.

From Italy Rubattino's immense fleet keeps up a service between the Mediterranean and New York, as does also the Fabre Line; from Copenhagen the Thingvalla Line began in 1879, and carries on the only direct service from Denmark, to New York; an important addition has been made to this fleet, in April 1893, by the purchase of the White Star Liner **Celtic**, which is now known as the **Amaraka**.

This line became noted a few years ago through the foundering, in April 1889, of one of their vessels, the **Danmark**, when not a life was lost out of 734 souls on board, all having been rescued by the **Missouri**, of the Atlantic Transport Line from London.

In 1872 the Dutch line, officially styled the Nederlandsch Amerikaansche Stoomvaart Maatschappij, of Rotterdam, but known in this country as the Netherland-American Line, commenced a regular passenger and freight

service to New York. By the purchase in recent years of several of the well-known Liverpool liners, as the **Baltic**, **Republic**, **British Empire**, **British Crown**, and others, they have established an excellent service between Rotterdam and New York, the steamers now being known under such names as the **Veendam**, **Maasdam**, **Rotterdam**, and **Amsterdam**.

Other lines trading across the Atlantic are the Spanish Compania Transatlantica, also the Bensaude and Andresen Lines, under the Portuguese flag, from Lisbon to New York, calling at the Azores.

CHAPTER IX.

THE WORKING OF ATLANTIC LINES.

LIKE the other great organizations formed in the nineteenth century for the use and convenience of man, the ocean steamship companies enter so much into the routine of life, that a brief glance into the manner and means by which the current—or circulation—of the beautiful vessels is kept up is likely to be of interest to many and useful to some.

In considering the subject, it will at once be apparent that it is necessary for the successful working of a Steamship Line that there should be one leading head to guide the entire organization, whether it be under public or private ownership. Acting under him comes the directing staff, which is practically in two separate sections. These may be termed the "Inside" and "Outside" sections.

The "Inside" section comprises the partners, directors, or managers, and, in conjunction with them, the heads of the various departments which are carried on in the office, such as the finance, accountant's, freight (inward and outward), passenger, and oftentimes insurance departments.

To the same section belongs the arrangement and

conducting of the various negotiations, incidental to the general business of the line—such as, the carriage of passengers, freight, and mails; the fixing of the sailing schedules; and the thousand and one details which must be fully worked out with the various connections, scattered throughout the portions of the world in which the line may be directly or indirectly engaged; also arranging with the feeders or carriers, consisting of the various railways and steamboat lines, running more or less in conjunction with them; and also, if they be mail steamers, advising and conferring with the postal authorities, to insure dispatch and regularity in the transmission of the mails and generally the utmost efficiency and safety.

The duties of the various heads of the departments are apportioned to men of great experience in their special line, so that each may be worked to its utmost capacity. The chief of the freight has for his duties the tracing, following up, and securing for his line the carrying of every kind of merchandise, machinery in transit, breadstuffs, dead meat, live cattle, bullion, and so forth, which it is possible to secure. In the passenger branch the same restless energy exists in spreading the great network of alluring advertisements — handsome pictures of the steamers, accounts of fast passages, details of accommodation—by the aid of active agents in every town of the various countries likely to use the watery highway on which the vessels of his line come and go.

The chief of the accountancy department, as the name indicates, has to keep straight the financial concerns of the whole undertaking, commencing at the first great item

of capital account, and going down through the immense number of departments in what may be called the home district, to the smallest transactions of all the branches and agencies in outlying foreign ports.

The more important matters of the line—such as the building of new vessels; the opening up of new services; the regulation of times of sailing; carriage of mails; agreements with governments; arrangements for charter, and such like—are, of course, retained in the hands of the principal and his partners or directors, and nothing is known of them outside until their proceedings are matured and definitely settled. As soon as any new step has been decided upon, the heads of the various departments are called upon to report and to point out the various details requiring development or improvement, each in his own special line, and from time to time proceed to the shipyard and engineering works, and regularly inspect the progress of the work, consulting with the owners and builders as the work advances, with a view of securing the latest and most modern arrangements.

The system by which the whole of the various departments and staffs are engaged in keeping up the working of the steamers is somewhat as follows:—On the arrival of each ship in the home port, the commander reports to the head office the more important events and occurrences of the voyage, and the heads of the three departments—deck, engine, and steward's—return a complete "indent" of the overhauling or work necessary in their divisions to their respective Superintendents. The latter then go into the various matters, satisfying themselves that the work

on the list is requisite, and orders for the work to be carried out are then given to whichever branch of the shore staff it comes under.

At the same time that this overhauling "indent" is handed in, a complete list is furnished of the stores consumed, of the quantity remaining on board, and of what is required for next voyage. This is also scrutinized by the Superintendents, and then passed on to the various officials, to have the articles supplied in good time for the next sailing date. Should there be any extensive or heavy repairs to be effected, or any important alteration to be made, the Superintendent of the department in question then brings the matter forward before the principals, and the details of the work (or, if necessary, the substitution of one vessel for another) are then arranged mutually with the other Superintendents.

In order to insure effective and perfect working, regular fixed meetings of the partners, managers, and superintendents are held, at which the commanders then in port also attend, and the various matters which from time to time require general attention are discussed and arranged, so that each department is kept thoroughly in touch with, and cognizant of the doings of the other. As it is impossible always to define the limits of where one responsibility ends and the other begins, the utility and, indeed, necessity of this system is obvious.

Turning now to the other great section, the "Outside," this, like the "Inside" section, is conducted under the head or chief, with the other partners or managers acting in conjunction with the heads of the engineering, sailing,

and victualling departments which are actually engaged in working the steamers.

The most important is naturally the engineering department, which embraces almost innumerable divisions, for all of which the Superintending Engineer is responsible. It is this department upon which, when a new steamer is about to be taken over from the builders, devolves the duty of arranging the engineering staff on board the vessel. This class ranges from the sailing chief engineer, with his staff of engineers, electricians, and refrigerating engineers, down to boiler-makers, greasers, firemen, and trimmers, and amounts now-a-days to a small army of over 200 men in all.

A very important duty is the up-keep and maintenance of the whole machinery of the vessel, not only in the engine department, which alone comprises upwards of forty different engines, besides the main engines, but also the auxiliary apparatus scattered throughout the vessel, such as windlasses, winches, steering-gear, and others, and the various parts of hull and deck which are subject to wear and tear. To these requirements must be added the incessant wants of the passenger departments, in the way of re-arrangement and extension of saloon or emigrant accommodation, the supplying and overhauling of the extensive fittings of the culinary and pantry branches, with the numberless minor but important requirements of a floating hotel.

To effectually fulfil these multifarious duties the Superintending Engineer has under his charge extensive repairing works, in which are located the various machines

and tools required to carry on the work of the different branches of manufacture and repair. Engineering, forging, smithing, brass and lead-founding, boiler-making, and general iron and steel work, plumbing, whitesmith's and tinsmith's work, brass-finishing, painting, carpentering and joinery, pattern-making, boat-building, sawing, leather working, laundry work, upholstering, electrical engineering, rigging, sail-making, electro-plating, and other kindred matters, are all placed under responsible foremen, who again, in most cases, have charge of a considerable staff to carry out the work on board when the vessels are in port. In the works are extensive stores, containing all the necessary articles constantly in requirement by the different departments, so that the vessels may be completely overhauled and outfitted by the line's own establishment and staff.

The other important department of the marine or "deck," as it is more commonly called, is under the control of the Marine Superintendent. This gentleman is responsible both for the general work of the ship in port, and for the efficiency of the navigating staff at sea; the latter consisting of the commander, officers, boatswains, quartermasters, and crew. The numerous other duties connected with the docking and berthing on arrival; the manner and rate of discharging and loading of cargo; coaling, and outfit for the coming voyage, also fall to his care. Acting with the Engineering and Victualling Superintendents, he generally, also, arranges for the work of the other departments which may require attention previous to commencing the next voyage.

The nature of this superintendence varies for almost every trip. At one time it is to extend or improve the saloon accommodation; at another, it is to arrange for dry docking, for the overhaul of machinery, or for surveying purposes. Sometimes the cargo holds may need attention; at others the meat chambers require alteration; on another voyage more extensive emigrant accommodation is needed; and, at all times, the equipment either in sails (which, however, are rapidly falling into disuse), or running-gear, or lifeboats, or such-like subsidiary requisites claim vigilant attention. Every now and then it is necessary to open-up, place in position, and expose all the various pump-gears, fire-hose, boat appliances, *et hoc genus omne*, for the annual inspection of the supervising authorities. Added to all these duties is, to a certain extent, the working of the freight at the quay side, for although this is controlled from the office by the freight department, it is necessary that the wharfingers and stevedores who manipulate it should work to suit the state of the ship.

Then comes the preparing for the voyage: seeing that the cargo and coaling is thoroughly completed; hatches and openings secured; decks washed down; and all made straight and fair, ready, with fit officers and crew, to receive the passengers and mails on the advertised date, and to pass the inspection, not only of the Government officials, but also the critical and exacting scrutiny of the partners or managers themselves.

The third division of the "Outside" section — the victualling department—is also under the charge of a responsible Superintendent, to whom is intrusted the

entire management of the stewards' department, the control of the outfit of the living-quarters both of the passengers and the leading sections of the crew, and the victualling throughout, including the supply of wines, medical requisites, and other articles necessary for the wants of so large a floating population. Besides the shore staff, the Superintendent is assisted on board by the purser, who generally takes charge of all the ship's papers and documents relating to finances, passengers, and freight; and who also, assisted by the chief and second stewards, supervises the working of the large staff required in the distribution of the saloon passengers in the berths and places assigned to them, in preparing for the daily meals, and in arrangements for cooking, baking, etc., so that the whole working may be such as to give satisfaction, insure cleanliness, and secure all necessary attention to each individual, whether in the state-rooms, saloon, or smoking-room. Another of the important functions of these officials is that of keeping a check upon the supply of the immense quantities of food and drink which are in almost continual demand. Not an unimportant object of attention for the Victualling Superintendent is the rearrangement of his staff, with due regard to the perpetual fluctuation in the number of passengers, as at one time the vessel may be full, and at another have but a few to provide for; so that, if too many hands are shipped, there is not work for them, and, on the other hand, if too few are shipped, the complaints of want of attention come in volumes from disappointed travellers.

To illustrate the elaborate system necessary for the

actual working of a twin-propelled Atlantic liner, it is only necessary to describe the general routine of the various departments, beginning with the news of her coming arrival in the Mersey, which is generally received by telegraph from Queenstown, and again from Holyhead.

On the news being received in the general management division of the office, the expected hour of arrival is at once communicated to the Post Office and Custom House, and an hour appointed for the steam tender to leave the landing-stage to meet the liner in order to take off first the saloon, and afterwards the other passengers, while if the mail be a heavy one, a special tender is set apart for it. The passenger department, on being informed, generally communicates the hour of the tender's departure to the various hotels, railway companies, and others directly interested, and makes preparations for the landing of the passengers and the examination of their baggage by the Customs.

With this tender goes the Victualling Superintendent, accompanied by the Health and other Government officers whose duty it is to pass the ship for entrance into port, and grant permission for the disembarkment of the passengers.

On the arrival of the various papers and documents at the office, the ship is entered at the Custom House and all the necessary formalities are gone through to allow the work of debarkation to proceed, whilst the clerical department at once commences the work of sending out advices as to the supplies of coal, and the delivery of outward freight on quay for the next voyage.

The Marine Superintendent and his department, on hearing the time of arrival, make all arrangements to dock and berth the ship as soon as possible after arrival, and get ready for the discharge of cargo, and the re-coaling. After the vessel is docked, the crew are paid off in the presence of a Board of Trade officer as soon as convenient, and now-a-days are at once signed on again for the next voyage. The chief officer then submits his "indent" for repairs, stores, and requirements for the next voyage, and this document guides the Marine Superintendent in his arrangements when the vessel is in dock.

As soon as the vessel is moored, work is commenced by the stevedores. The hatches are opened and the discharge of the cargo is busily proceeded with by a small army of men, some unloading and others coaling for the coming voyage. Immediately the holds are empty the re-loading is commenced, so that no time is wasted, and it is no uncommon thing to discharge 4000 tons of inward and load 3000 of outward cargo, and also put about 2000 tons of coal into one of these vessels in about two working days.

In the engineering department the work, although altogether out of the public sight, is much more extensive. As soon as the engines are stopped, the large staff is started to wipe down the machinery, blow down the boilers, or otherwise let off steam, and generally prepare the whole for inspection and overhauling.

The simpler portion of this is done at once; and when the chief engineer's "indent" has been through the hands of the Superintending Engineer, the important or heavy

work is proceeded with; both the sea-going and shore staff working conjointly, as the former are altogether responsible for the proper overhauling and adjustment of the moving parts, so as to insure good working at sea. The boilers after being cleared of the enormous quantity of ashes, soot, and rubbish, always consequent on such a large number of furnaces, are carefully cleaned out; if necessary the inside is scaled, and the whole is thoroughly overhauled by the ship's boiler-makers and the shore staff under an experienced foreman, and also under the keen supervision of the chief and second engineers, who are thoroughly alive to the fact that good work in port means less trouble at sea.

In addition to this work there is also the overhauling of the machinery in other parts of the vessel, and the sundry repairs required in the other departments, which only can be effected by skilled mechanics.

After the passenger department has finished with the disembarkation of the passengers, the chief steward turns his staff to clearing away and sorting the numerous *articles de voyage* which have been in use throughout the trip, some being put aside for next voyage, and others sent to the company's works for repair or overhaul. Of these, by far the most extensive is the "linen," as it is generally termed, and it may be here mentioned that so extensive and complete are the laundries that the whole of the table and bed-linen for over 300 saloon passengers can be returned to the ship in the space of forty-eight hours ready for use, thoroughly pressed and aired. As soon as the clearing up has been done and the Victualling Superin-

tendent has passed the "indent," the saloon, state-rooms, and other quarters, together with all furniture, are thoroughly overhauled and refurbished. The galley and pantry meanwhile are also being attended to by their respective staffs, aided here again by the shore staff, and the various cooking and serving utensils are replaced or sent to the works for repair. It is almost impossible for an outsider to realize the immense quantity of large and small articles which continually require repair or renewal in this department of large passenger vessels, and for the large liners an immense staff of tinsmiths is required to be continually at work, both in making new and patching up worn articles.

Another class of men kept continuously at extensive work are the carpenters and joiners, and also cabinet-makers, who, under an experienced foreman, are constantly engaged in the saloons, state-rooms, steerages, deck-houses, hatches, stores, and crew's quarters. The elaborate and extensive lavatories now-a-days required, also command the constant attention of experienced plumbers, owing to the labyrinth of pipe arrangements in the ship, which supply fresh and take away the waste water.

Draughtsmen are also constantly occupied in noting and making drawings of the changes and alterations continually being effected, both to keep pace with improvements and to further economize.

Besides all these hands directly engaged in work about the ship, it is necessary to retain, both at the quay side and the works, a large staff of book-keepers, clerks, and time-keepers to attend to the extensive wants of the

clerical department; and in addition, reliable watchmen to take charge during the hours when the workmen are off. One officer and engineer are also required to be on board, and certain others of the steamer's crew ready to act in case of fire or other casualty.

In addition to the overhauling for an ordinary stay in port, must be reckoned the very great extra work entailed if there be any heavy machinery to replace or any mishap on a voyage to repair, and also when the annual Board of Trade inspection required by law on all passenger vessels becomes due, as the vessel must then be put in dry dock. To this requirement must be largely attributed the excellent conditions and regulations now existing on all passenger vessels, although great credit also must be given to the enterprising owners, when urged by competition, for going even further than the requirements, in adopting all possible means to increase the safety and comfort of their passengers and crew.

In order to show the excellence of this annual inspection which is invariably carried out by the Board's own Officials (men of tried experience), it will not be out of place to briefly describe the routine and conditions necessary to obtain the renewal of the passenger certificate. The first thing is to pay into a mercantile marine office the necessary fees, which vary in amount according to tonnage, at the same time giving notice of where the vessel is lying, and also the hour she will be ready in a graving dock for the purpose of allowing the surveyor to "sight," otherwise carefully survey the bottom, propeller, and all other fittings not visible afloat, which must be

done before any painting or exterior work is effected. This is looked upon as the most vital point of the survey, the passenger certificate always dating from the day of sighting.

Other matters examined by the surveyors are the deck and other fittings and gear; the holds; and the hand and steam bilge-pumps, which must have all parts actually shipped in place, and the valves and interiors open for examination; in addition as many of the bilge strainer boxes as possible must be exposed, together with as many of the limbers,[1] in order to examine the state of the cement in bilges and to note any signs of working of the ship itself. The bulkhead sluices[2] must also be turned, the water-tight doors closed and opened, the handles and fittings for these being permanently attached or suspended in convenient position alongside. The fire-hose must be connected to the water service, and be stretched out for inspection with projecting nozzles attached, and connecting keys in place.

The elaborate equipment of boats has to receive careful attention; each must be uncovered and actually have on board the necessary sails, masts, yards, oars, thole-pins, and rowlocks, attached with strong chains; rudder and tiller ready in place, plugs, bailers, two fresh-water breakers or casks, bread-tank, life-belts, and axe, so that each article can be thoroughly inspected.

[1] "Limbers," the spaces between the frames of the vessel in the bottom under the ceiling.

[2] "Bulkhead sluices" are the valves in the bulkhead, etc., running through the bulkheads.

The capacities and lowering arrangements of the boats —which are strictly defined, not only by the British but also the United States authorities—must be up to standard, and a complete list of their sizes and capacities, when required, must be handed to the surveyor; the boats must also be lowered into the water to test the gear and their water-tightness.

All the scheduled signal and spare lamps must be cleaned and open for survey, the various fog-horns, rockets, etc., for night signalling, and the sounding leads, must be submitted to inspection.

The anchors must also be cleaned and scraped, with the official and proof numbers distinctly visible, and, in dry dock, the whole of the cables must be run out in the bottom of the dock and have the shackle-pins all backed out, so that the numbers may be verified with the certificates of tests.

A still more extensive survey has to be gone through in the machinery departments; the whole of the working-parts, such as cylinders, valves, pistons, pumps, crank-pins, bearings, safety-valves, fresh-water condensers and other portions must be opened up for inspection, also the boilers both in the steam and on the fire sides; it is also necessary at stated intervals to take off the propellers and draw in the stern shafts for examination. This precaution is now generally taken every twelve months by most of the leading lines, a practice strongly to be commended.

In addition to these requirements all the official papers of the ship, namely, ship's register, the various certificates relating to the compasses, chains, and anchors, and also

those of the captain, chief and second officers, and chief and second engineers, have to be presented for notification.

After all these steps have been completed, the Board's surveyor has to send to the principal office in Whitehall, London, a declaration made by him stating that the ship is complete in all requirements. On receipt of this the certificate is forwarded to the owners, which allows her to carry passengers for a stated period.

When it is remembered that, in addition to all these requirements, very extensive rules and regulations of the Board of Trade have to be complied with by the builders of the ship and machinery previous to the vessel's obtaining a certificate, it is evident that but little is left to be desired in the thoroughness of the protection afforded to the marine travelling public by the British Legislature; and when the enactments are carried out by the surveying staff with much ability, intelligence, and willingness to help at all times, as the author has experienced for over fifteen years, there is no doubt they prove a strong incentive to all concerned to aim at and achieve a higher grade of perfection in the safe and perfect working of high-speed passenger vessels even than that now reached.

True it is that now and again murmurs of discontent arise from some enterprising builder or engineer, or from some far-seeing shipowner, who finds a restriction placed on some new untried advance; but if a successful trial proves a new idea to be satisfactory and safe so far as human life is concerned, which is the Board of Trade's first requirement, then ready acceptance may be obtained, even if outside the usual authorized forms.

In addition to this annual inspection in the home ports, another has now-a-days to be undergone by the surveying staff of the United States Government, who, some twelve years ago, enacted a law which rendered it compulsory for all vessels carrying passengers from the ports of that country to have a certificate, granted on somewhat similar conditions to the British regulations.

Returning now to the direct working of the ship: as soon as the advertised date for sailing draws near, the "Outside" section having had the work on board completed and all departments in order, steam raised and engines tried, and everything ready to receive passengers, while the "Inside" section has transacted all its portion of the work, definite dates are announced for the embarkation of first the steerage, then the second class, and finally the saloon passengers. This may take place at the loading berth in the company's dock, but more generally from the landing-stage, a notice of these hours being widely circulated. At a certain specified hour the official clearance takes place on board, which means the passing of the ship by the Health and Emigration officers, as well as by the Board of Trade, the Customs clearance having been arranged previously, so that the vessels may go out of dock into the river and await the passengers and mails.

The form of clearing a vessel is carried out by two Government officers, one being a sea-going officer of tried experience from either the Royal Navy or Mercantile Marine, and the other a fully qualified medical man; these two gentlemen upon arrival proceed to examine the steerage passenger accommodation as to sleeping, lavatories,

exits, ventilation, and other necessaries; afterwards each individual steerage passenger, adult or child, has to pass the medical officer, to provide against the chance of any infectious disease on the passage. The medical outfit is subjected to examination, and the entire crew has to be mustered and pass the inspection of both officials, so as to insure their being fit and able men for their respective duties. A careful examination is also made of the life-boats, some being lowered into the water, and often an inspection of other details, such as night signals and rockets, the supply of fresh water, freeboard, etc. The necessary papers being filled in and signed, the vessel is cleared, and ready to proceed to sea as soon as the saloon passengers and perhaps mails are on board.

The embarkation of the saloon passengers, which, as a rule, is the final scene, takes place from the dock or landing-stage at a convenient time shortly preceding that at which the vessel gets under weigh, and is accompanied with much bustle and stir but no confusion, everything being done systematically.

The celebrated landing-stage, which plays so useful a part in the coming and going of the Liverpool Trans-atlantic liners, is one of the most important appurtenances of the great port on the Mersey. Notwithstanding its close proximity to the surface of the water, it was completely destroyed by fire on July 28th, 1874. This disaster was occasioned by some workmen, who were working near the embayment in the stage, allowing a naked light to set fire to some of the creosoted wooden beams then existing below the deck of the stage, and

owing to the inflammable nature of the material and to its inaccessibility, no effectual means could be found to extinguish it, so that the whole structure, extending nearly half a mile, was totally destroyed. No lives were lost, but the reconstruction of the stage occupied a considerable period, and entailed a cost of over £250,000.

Upon the arrival of the tender with the saloon passengers alongside the ship, the commander and officers are in attendance at the gangway to receive them, and all the stewards ranged ready, under the purser and chief steward, to direct them to their different rooms and berths, and attend to the removal of the smaller baggage; the larger baggage (which is despatched by another tender) being stowed by the deck department in quarters specially set apart for it. After a short period, the whole of the passengers and their baggage being on board, and all ready for sailing, the tender leaves and returns to the stage with the owners or representatives, and officials of the company, and, if the state of tide permits, the vessel gets under weigh at once under the supreme charge of the captain, whose station is on the navigating bridge. With him is also the pilot, whose duty it is to navigate the vessel through the channels and passages for which he is duly licensed. There is also on the bridge, alongside the captain and pilot, the fourth officer, whose duty is to transmit the engine-room and steering orders.

The chief officer's position when leaving or entering port is in the bow of the ship, to attend to the working of the anchor, and other duties in that quarter; to attend to the stern, the second officer takes up his position on the poop;

the third officer gives special attention to the prompt carrying out of the orders given to the quartermaster at the wheel, and so on, each officer having a proper station and duty assigned to him.

In the engine department, also, the duties of each of the staff are distinctly defined for the time of leaving and entering port; so that nothing is left undone to secure systematic working throughout.

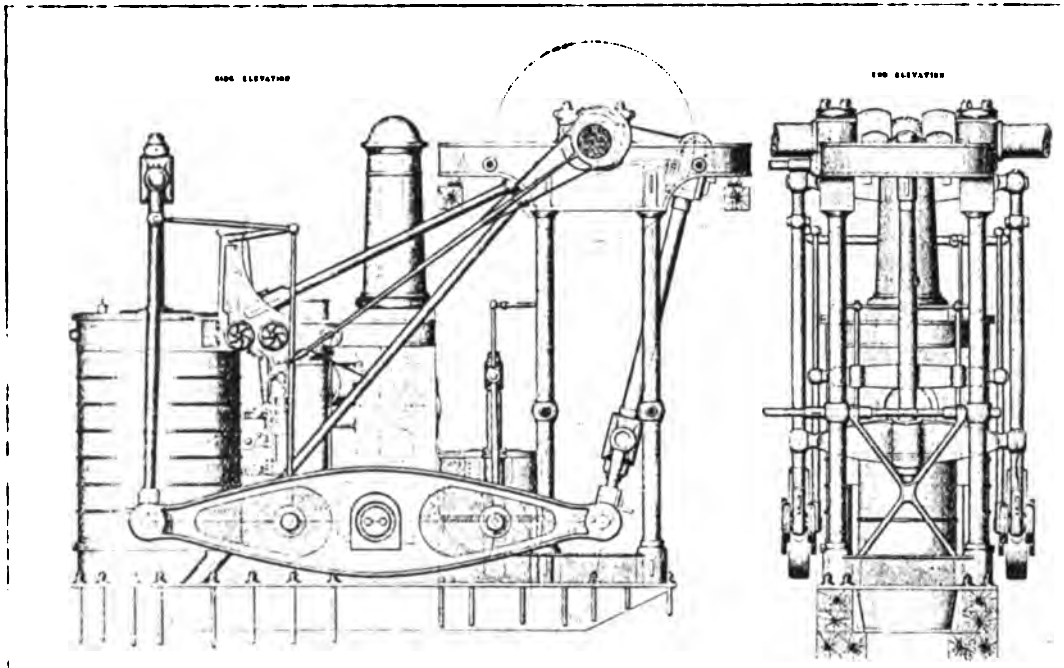
After the vessel has got fairly under weigh and cleared the channel, the "stand-by," as it is technically termed, is dispensed with, and the duties are changed for the regular watches at sea, not to be changed again until the arrival off New York, except in event of foggy weather coming on at sea.

CHAPTER X.

MACHINERY OF ATLANTIC LINERS.

ALTHOUGH the type and construction of the engines have been generally defined in noting the steamers already mentioned, it may not be uninteresting to briefly review the changes in design of the machinery in use at different times. The first engines were of the side-lever type, which is illustrated by the sketch of the machinery of the **Arctic** (p. 125). The earlier engines in the **Liverpool, President,** and **Sirius,** were all of this type, but lacked their finish and completeness, and also carried lower pressures, such as 5 lbs. and 8 lbs. per square inch; with them the consumption per indicated horse-power averaged as much as 6 or 7 and even 8 lbs. of coal per horse-power per hour. The design of boilers generally used was that known as the return-flue boiler, and served its purpose until the pressures became too high for the large area of flat surfaces exposed, which were found to want considerable staying.

The pressure carried in the earlier days was so slight, that in the log-book of the **Britannia** it was recorded on one occasion: "Broke the larboard steam-pipe, lapped it with canvas and rope-yarn and proceeded with low pressure," meaning evidently 4 lbs. or 5 lbs. per square inch! So much has been noted of this old vessel, that it is in-

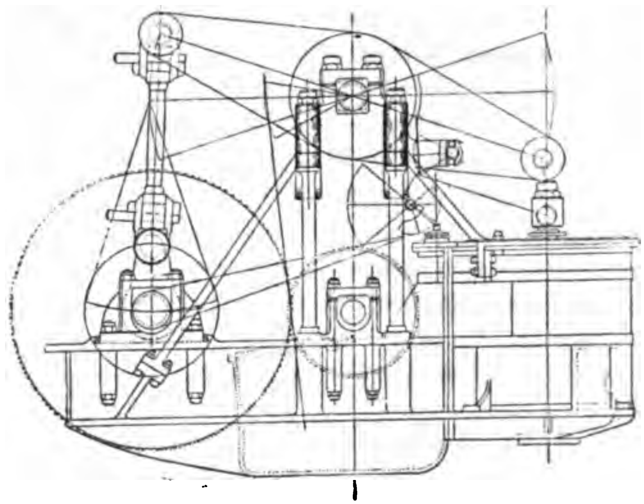


ENGINES OF THE U.S. MAIL STEAMER ARCTIC, 1849.

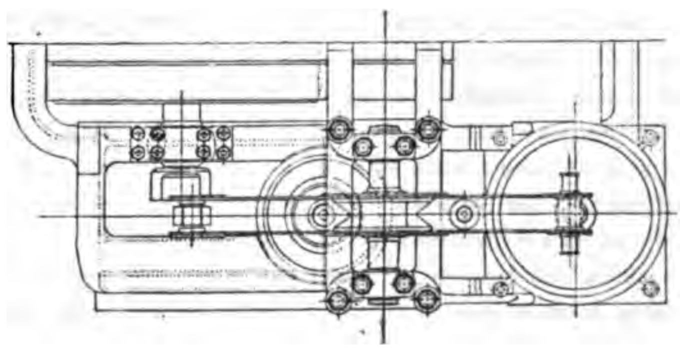
teresting to here give the names of the first engineers who served on board. The chief was named Mr. Peter Kenneth; the second, Mr. Thomas Brown; the third, Mr. James Bell; the fourth, Mr. Robert Waddell, who afterwards rose to be chief engineer of the **Scotia**; and Mr. James Wardrop, fifth.

The design of the side-lever engine being fairly suitable for the paddle-wheels, was generally retained down to the **Scotia**, the last of the side-lever type, and it was still such a favourite as to induce modifications of it being retained for screw propulsion in the form of a beam-engine. The arrangement of this type is illustrated by the diagram of the engines of the Cunard steamer **Etna**, built in 1855, on p. 127. It will be noticed that the two cylinders are placed on the port side to work vertically up to the beam, the other end of which is connected to the shaft on which the spur-wheel is keyed; this wheel gears into a pinion on the forward end of the propeller-shaft, and, with a view of obtaining a good disposition of the weights, the wheels were placed between the forward and after engine, of which the forward one only is shown on the sketch.

This system of gearing for screw engines of what were then considered large power, was introduced to keep down the high piston speed which would have been required if the engines had had their piston-rods and crank-shaft connected direct to the screw-shaft, the revolutions for a side wheeler ranging from 14 to 18 per minute, whilst those for the screw-shaft required to run from 40 to 80, 90, and sometimes even 150, which was then considered much too fast for ordinary wear and tear.



End Elevation, looking Aft.



Half Plan.

ENGINES OF ETNA, 1855.

An interesting anecdote, which illustrates the marked difference between the relative velocities of the paddle-wheel machinery and the direct-acting inverted screw engines, is often told of one of the older chief engineers, who had been transferred from the charge of one of the slow-moving paddles to a quick direct-acting screw. He was struck by the apparent working full speed of the engines, although the order from the bridge had been given to go slow ahead; after surveying the situation for a moment, he called out to the second engineer, who was handling the engines, "The order is to go *slow*, better slow her down at once." To this the second replied, "They are going dead slow;" on which the chief at once answered, "Is that so? Well, they may get some one else to take charge of this job, for I won't be in the engine-room when they are going full speed, as it would not be safe, they are sure to fly to pieces."

Another form of geared engine for screw propulsion, was the steeple type introduced in the earlier Inman steamers. Considerable trouble was experienced in all these engines with the gearing, owing to the heavy wear, which required constant renewal of the wooden teeth, and it was eventually found that they gave more trouble than the engines connected direct on to the screw-shaft.

After the engines for screw machinery were arranged so as to be connected direct to the propeller-shaft, many types came into vogue, each line favouring its own form, the Inman adopting the horizontal trunk engine, first fitted on the first **City of New York**, built in 1861, the Cunard the inverted direct-acting in 1865 on the **Java** for

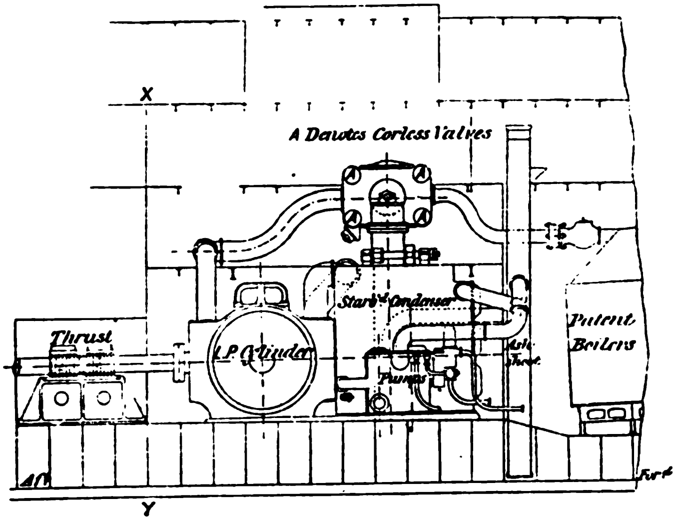
the Atlantic Mail Service, followed afterwards by the Guion and other lines.

The Guion Line in its first vessels adopted the inverted direct-acting engine, but afterwards changed, in the **Wyoming** and **Wisconsin**, to the type having one vertical cylinder and one horizontal with trunk, both working on the same crank. They were followed afterwards by the type shown on pp. 130, 131, which were fitted in the **Montana**. There was one inverted high-pressure cylinder working direct on the forward crank-shaft, and two horizontal low-pressure with return connecting-rods, one on each side of the vessel. The valves of these engines, as also of the **Wyoming** and other vessels, were of the Corliss type, as may be noticed by the shape of the cylinders and the parts marked A.

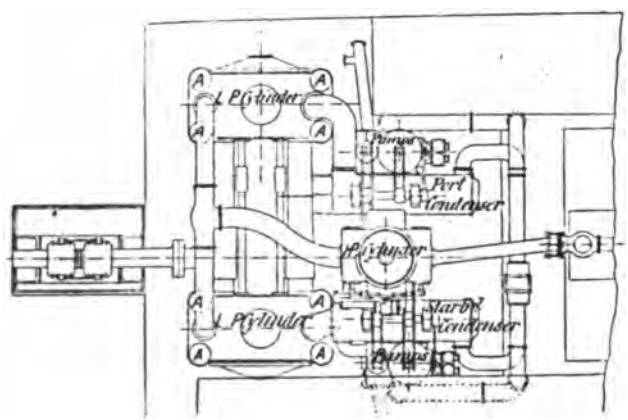
Another peculiarity shown on this diagram is the vertical ash-shoot, into which the overboard discharge of the circulating water is led. The idea of this shoot, which was first introduced on the earlier White Star boats, was to avoid the annoyance caused in passenger vessels by the putting of the ashes overboard, but it was, however, only a partial success, giving rise, like many other contrivances, to greater evils than it cured, so that it was eventually done away with on all vessels.

Another feature of the two sister vessels, the **Montana** and **Dakota**, is clearly shown on the section, namely the excessive "tumble home"[1] of the vessels about midships, which gave them a very peculiar appearance.

[1] This term "tumble home" is used by nautical men to denote the manner in which the sides of the vessels gradually recede



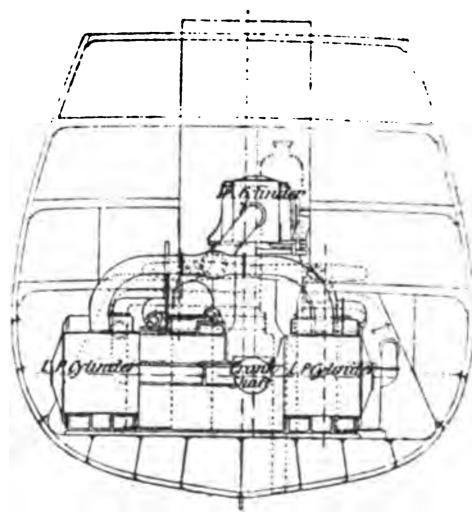
Fore and Aft Elevation.



Plan.

THREE-CYLINDER COMPOUND ENGINES, MONTANA AND DAKOTA, 1872.

Since the general introduction of the compound engines in 1870, the inverted direct-acting type of engines with two cranks has become almost universally adopted. Where the arrangement of one high and one low-pressure cylinder has been departed from, it was generally to get more power by placing the high-pressure cylinder



Section at X Y looking Forward.

THREE-CYLINDER COMPOUND ENGINES, MONTANA AND DAKOTA.

above the low, tandem type, as instanced by the sketch of the first White Star boat's engines illustrated on pp. 68, 69. Sometimes the high-pressure cylinder was

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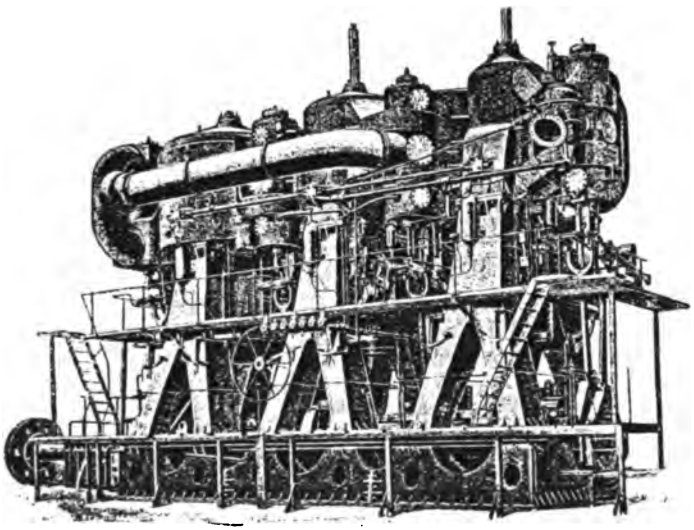
inwards from a little below the water-line to the deck level; this was done to a great extent in the old three-decker line-of-battle ship.

placed underneath the low; but all these designs have once more given place to the simple arrangement of the triple compound engine with three cranks, illustrated herewith. Owing, however, to the great demand for still higher indicated horse-power, the tandem system seems



THREE-CRANK TRIPLE ENGINES, 1888.

again coming into vogue with triple engines, as it enables two high-pressure cylinders to be placed above the two low-pressure, which, as already noticed, is the arrangement of the new high-speed vessels **Campania** and **Lucania**.

During the time the side-lever engines prevailed, gradual improvements were made in it by increasing the boiler

pressure, piston speed, and other details, so that its efficiency was immensely improved, as may be seen from the tables following, in which the particulars of the first vessel, the **Savannah**, are also given for the sake of comparison.

The effect of the gradual improvements in the screw-propelling machinery is also clearly shown, the years 1850—1854 practically representing the period of geared engines, the year 1861 the numerous forms of trunk (horizontal, diagonal, and other types), the years 1871 and 1881 the prevailing type of compound tilt hammer or inverted direct-acting, and the later dates the triple expansion type.

TABLE I.

Year.	Displacement.	Speed Propelled.	Indicated Horse-power to Displacement Ton.	Fuel per Indicated Horse-power.
		PADDLE VESSELS.		
1819	1,850 Tons	6 Knots	·0048	10 Pounds
1838	1,980 ,,	8 ,,	·03	6·5 ,,
1840	2,050 ,,	8½ ,,	·036	4·7 ,,
1850	6,500 ,,	11½ ,,	·3	4 ,,
1856	8,700 ,,	13½ ,,	·46	3·07 ,,
		SCREW VESSELS.		
1850	2,910 Tons	9 Knots	·27	6 Pounds
1854	3,200 ,,	10 ,,	·36	4·5 ,,
1861	4,950 ,,	11¾ ,,	·33	4 ,,
1871	7,100 ,,	13½ ,,	·4	2·1 ,,
1881	12,300 ,,	17 ,,	1	2 ,,
1885	13,300 ,,	19 ,,	1·06	2 ,,
1887	17,270 ,,	20·8 ,,	1·07	1·6 ,,
1892	20,000 ,,	22 ,,	1·5	1·4 ,,

TABLE II.

PADDLE VESSELS.

Year.	Machinery Weight, Pounds per Indicated Horse-power.	Piston Speed, Feet per Minute.	Displacement Tons.	Displacement Absorbed by Propelling Power, %.	Indicated Horse-power.
1838	1,500	170	2,300	46 %	700
1862	1,000	360	8,755	40 %	4,000

SCREW VESSELS.

Year.	Machinery Weight, Pounds per Indicated Horse-power.	Piston Speed, Feet per Minute.	Displacement Tons.	Displacement Absorbed by Propelling Power, %.	Indicated Horse-power.
1850	1,200	200	2,910	42 %	800
1861	800	300	4,500	34 %	1,500
1871	490	530	7,100	22 %	3,000
1881	490	680	12,300	40 %	12,000
1891	480	860	17,270	39 %	18,800
1893	490	1,000	20,000	47 %	30,000

By this it will be seen that high piston speed, which practically retarded the adoption of the direct-acting screw engine in early days, has increased, and is increasing, far beyond expectations. This must be viewed with satisfaction, owing to it being the great factor in the gaining of even greater horse-power in the future, which, as already noticed, will be looked for immediately on the production of a more efficient boiler.[1] The proportion of displacement absorbed by the weight of the machinery and fuel shows in a marked degree the magnitude of the machinery now required, notwithstanding the very substantial reduction in weight per indicated horse-power, but, at the same time, it is remarkable that the displacement absorbed by

[1] Since this was written a new form of boiler, somewhat after the locomotive type, has been produced, which will, no doubt, enable another advance to be made.

the machinery and fuel of the **Campania** is almost the same as in the liners of 1838, and something less than in 1840, namely, 47 per cent.; but if the 30,000 indicated horse-power engines of to-day were to be built upon the weights prevailing in 1840, the machinery alone would nearly equal the whole of the displacement of that vessel (**Campania**), as it would reach 18,750 tons, and would require a consumption of something like 1500 tons per twenty-four hours.

It is remarkable that since the introduction of the three-crank engine, the number of disablements through the breakage of crank or tunnel-shafts has been considerably reduced during the last nine years, and the wonderful immunity from breakdowns which characterizes the vessels of the Atlantic Ferry is worthy of notice, although the voyage is admittedly the wildest and most trying in the world.

Taking the year 1892, although there were no less than 4000 sailings from ports on each side of the Atlantic, only seven breakdowns of machinery could be traced which caused serious delay, and only three total disablements.

Such a gratifying condition of things, even in this age of unique achievements, is worthy of note, and, although redounding to the credit of both builders and owners in proving that the best designs, materials, and workmanship have been utilized, it would be idle to deny that, were it not for the care and attention taken and given by the engineers at sea, the men who bear the heat and brunt of the day, from the chief downwards, the result would not be so satisfactory, nor the advances which have been made become practicable.

The readiness and aptitude of these engineers to adapt themselves to all the numerous demands made upon them by increasing improvements and refinements can be conceived, when it is borne in mind that the following extensive additions have been made to their duties since 1878, when, as already noticed, the indicated horse-power was under 6000—namely, double bottom ships with their elaborate pipe and pumping arrangements, electric-light machinery and connections, refrigerating gear of all kinds and sorts, independent steam pumps for every possible use, fan engines for forced draught, ventilating engines, and, lastly, the multiplication of the propelling machinery, as where there formerly existed but two crank pins and six sets of cylinders and valves, there are now six crank pins and ten sets of cylinders and valves.

These, added to the increased number of boilers and their attachments, must be seen to be realized, and yet in every case, thanks to their intelligent ability and close attention to duty, each new liner as a rule represents a still further advance upon those which have gone before.

In describing the improvements made in the machinery of the express liners, it is remarkable what little advance has taken place of late years in the design of boilers, and it may not be out of place to here glance back upon the development of that important factor. In early days but little knowledge of boiler-making existed, and iron plate construction work generally was but little understood, and as there were practically no tools to help the manual labour, it may be readily conceived that low steam pressures followed as a necessity.

The following remarkable quotations from a technical book of the period, showing how difficult it was to make ironwork absolutely tight, will be read with interest—

"In iron boilers, when water is first admitted after construction, hundreds of weeps or channels in the plates and rivets where water oozes are totally disregarded, the most important only being stopped mechanically; the rest are stanched merely by the rust the water has formed in its passage, and, the bulk of oxide being greater than that of the original material, lingers where it is formed, and thus becomes a perfect iron cement, and the boiler tight."

Being the easiest to construct, the rectangular flue boiler was generally adopted, and so long as the pressures were low it answered its purpose, but to the engineers of to-day it almost sounds like a dream to be told that a reverse valve must be fitted to each boiler to prevent a vacuum in the boiler, when the steam was low, which might cause it to collapse if it fell below atmospheric pressure. A peculiar addition to the machinery fitted to the **Great Western** was pumps working constantly, pumping the water out of the boilers into the sea to prevent undue accumulation of scale—a system which was continued for many years afterwards in the low-pressure days under the name of blowing off or brining.

Almost the first successful change which was made from the flat-sided flue boilers was that already noticed as being introduced by the Americans on the Collins liners **Atlantic** and **Arctic**, in 1849 and 1850. These were constructed a rectangular shape, of plates $\frac{3}{8}$-inch thick, having 1400 tubes in each boiler, 2 inches external diameter, fastened by expanding at ends as at present, but the tubes were

placed vertically, having the water inside and the flame around them outside. Although these boilers gave good results, they never found favour with the English engineers, those adopted in this country being the boilers which are still extant for low pressure, namely, the rectangular multitubular boiler, with the tubes placed horizontally. This design of boiler was introduced on the Atlantic in 1852 on the Cunard **Arabia**, the difficulty experienced in keeping the flue boiler tight and in order, at the higher pressures of 15 and 20 lbs. then coming into vogue, being very considerable. These boilers were built in two ways—one being the wet bottom, as it was called, owing to the furnaces having the water under them, and the other the dry bottom, in which the water space terminated at the sides of each furnace, so that the furnaces were altogether open at the bottom, which required an ash-plate to be fitted. This design of boiler answered its purpose admirably with pressures up to about 30 to 40 lbs., but towards 1867, owing to still increasing pressures, the now well-known cylindrical boiler, with internal furnaces and return horizontal tubes, came into use, and, with numerous varieties of combustion chamber arrangements, has since become universally adopted in the Merchant Service, either as single or double-ended, and oftentimes modified to an oval shape. The question of superheaters, which in the low-pressure days was so much talked of, has passed into oblivion, and owing to the high pressure now prevailing is not likely to be revived.

As regards the placing of the boilers on board ship many systems have been adopted. In the early days the

boilers were placed back to back, with furnaces fired fore and aft; later, one set of boilers were placed abaft the paddle-engines, and another set forward, thus requiring two funnels. Another system was to place the boilers on each side of the ship, with the backs to the ship's side, so that all the furnaces were fired athwartship from one long stokehole. Since the introduction of the double-ended boilers, however, the general plan of placing them so that the furnaces are fired fore and aft has been adopted, and on large vessels this arrangement adapts itself well to the numerous bulkhead divisions. The heaviest plates used in the shells of *iron* boilers were those on the **Wyoming** and **Wisconsin**, which were 1¼ inches thick, the boilers being each 16½ feet diameter by 23 feet long, with ten furnaces in each, all opening to one combustion chamber; but owing to improved appliances and the high pressure of to-day, shell plates of 1½ inches steel have been used, steel having come into use for marine boiler making since 1876.

From the introduction, in 1868, of the cylindrical boiler now in general use down to the present day, practically no change or advancement in its efficiency has been effected to any degree, the alterations or improvements being in detail, as instanced in the adoption of the Serve tube, which of late is being largely adopted, and also in design of furnace, which, by being corrugated or ribbed, practically brought the triple-expansion engine into use, owing to readily allowing higher pressures to be carried in the cylindrical internal flue boiler, thus avoiding any radical change in their design. Owing to the more or less general failure of all the patent water tube boilers tried

on ocean steamers, owners and engineers were and are reluctant to risk boiler experiments on a large scale.

Before leaving the subject, however, it would be well to consider if it is not now time for an improvement to be looked for, and to turn attention to the want of a new form being introduced which would substantially reduce the great weight and space required by the present marine boilers.

Of all the various forms used, marine engineers generally look to the locomotive boiler as coming nearest to meet their requirements. Several vessels have been fitted with a form of locomotive boiler in the past, but with disappointing results, notably H.M.S. Polyphemus, in 1881; but great advances have been made since then, owing to the use of high-pressure steam rendering it necessary to pay particular attention to the feeding and general working of boilers at sea to prevent excessive straining, and furnaces coming down, also want of circulation, and undue formation of scale, etc.

As a consequence, no liner now-a-days is without evaporators, feed-heaters, and feed-filters, which are now coming extensively into use. By the use of these various appliances, practically pure distilled water only is now used at sea, and thus removes one of the great obstacles to successful working of this form of boiler on board ship, so that it only remains for an enterprising Atlantic line and engineering firm to take the step and test it under the favourable conditions now existing. That this change is well worth considering may be seen from a comparison in a paper read before the Institution of Naval Architects in 1888, in which, amongst several war vessels, are given two

of exactly equal indicated horse-power, one with modified locomotive and the other with naval boilers, the weights with water being 49 and 74 lbs. per indicated horse-power, respectively; in other words, the locomotive boiler effected a saving in weight of 33 per cent., which, on the weight of the **Campania**, would mean a gain of 400 tons in earning weight. When this important feature, together with the saving of space amounting to over 6 per cent., is considered, there is no doubt the change will soon come about, as it will be a great factor in enabling the still greater horse-power to be gained which will be required for the successors to that vessel. It is, however, to be hoped that the same immunity from boiler explosion may be experienced in future, as in the past fifty years of the Atlantic service, no explosion has been recorded, although a few lives have been lost through minor failures.

One other section of marine engineering, like the boiler, has practically undergone no change since its first use on the old side-wheel **British Queen** in 1838—that is, the surface condenser, the arrangement and design being the same to-day, with slight improvements in packing the tubes. The condensing water is also circulated by pumps now generally of the centrifugal type. Up to date no attempts have been made, except on very small vessels, to utilize the motion of the ship through the water to cause the circulation, as was tried in former years. The only radical change is that, in order to reduce the weights, the shells of the condensers are now of either brass or copper, the former being most used.

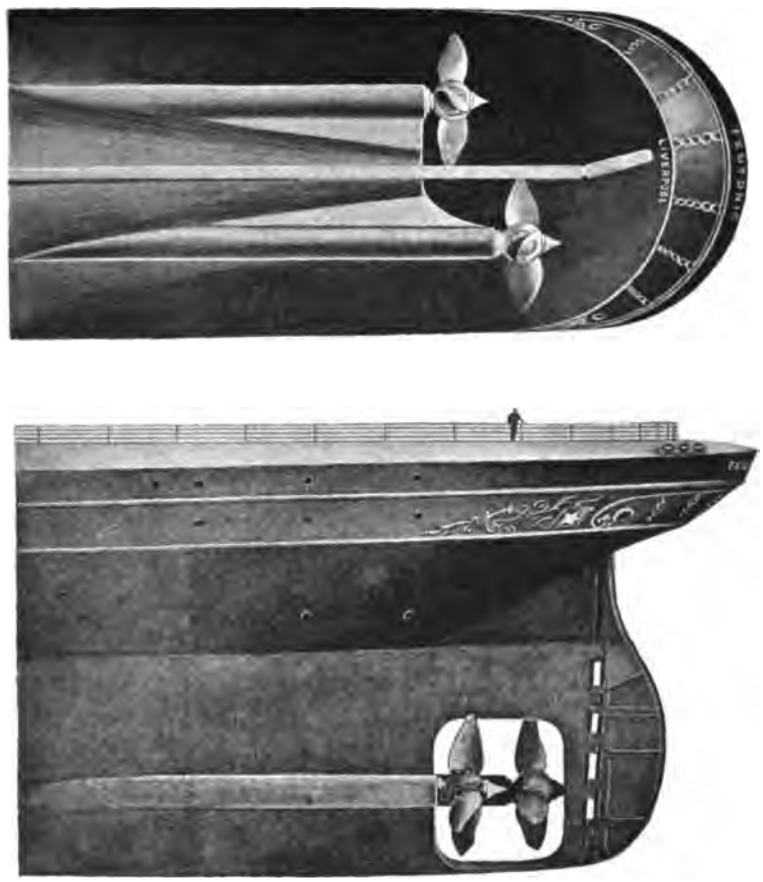
The introduction of the electric light, forced draught,

and refrigerating engines, has added many extraneous machines to the modern engine-room, and in the development of these auxiliary engines their construction has become a speciality of many firms, with the result that they are all of superior make, and do their work most satisfactorily, requiring but average care to keep them in order at sea.

One of the most radical departures of recent years is of course the twin screw, which, as may be noticed, has brought about an alteration in the design of the stern from the single screw type long in vogue, and will no doubt be retained, owing to its simplicity, for many years to come, when moderate power and speed only are required.

The simplest form for the twin screw, and the one generally adopted by the different governments, is that illustrated on p. 51, which serves to show the arrangement of the **New York** and the **Paris**. This, as will be seen, does away with the screw port forward of the rudder, and allows the hull to be built solid out to it, the shafts being supported at the propeller by heavy brackets, as they are termed, and covered with a protecting casing to the stern tube.

The other system is that adopted by Messrs. Harland and Wolff, namely, the overlapping propellers. This necessitates a screw port, as in the single screw arrangements, but as this opening is no disadvantage, and the advantages of the design and the results obtained have been satisfactory, it is likely to be more extensively adopted. The arrangement of the after-part of the hull, as may be seen from the illustration on next page, is so designed that it is built with the frames and shell-plating projecting



To face page 142

TWIN SCREW STEAMERS TEUTONIC AND MA

outwards in the wake of the shafts, which forms a convenient recess inside the ship for the shafts; it also possesses the great advantage of allowing the stern tube to be fitted exactly as in the single screw arrangements, which gives a desirable support to the shaft and propeller, besides keeping everything as far as possible secure from danger.

The designs of the propeller, like those of the boiler, have practically undergone but little change during the past fifteen years, the system of having blades bolted on to the propeller boss being now universally adopted for the express steamers, the material for the blades being manganese bronze, and for the bosses cast-steel or cast-iron. Up to the present the largest propellers yet made have been those on the **Umbria** and **Etruria**; these are 24½ feet diameter, 33½ feet pitch, 216 square feet surface, and weigh about thirty-nine tons each, each blade being about seven tons. Of late the number of blades has been reduced on the twin-screw vessels from four to three, which has given a slight improvement.

When it is remembered that the cost of the manganese bronze for the propeller blades averages about £120 per ton, some idea of the costs of the machinery of the great liners may be formed, the four blades for one of these steamers costing £3360, and the boss about another £1000, so that the total cost of the propeller alone, fitted in place, is but little under £5000.

One of the numerous requirements necessitated of late years in the engine-room, owing to the great advance of the steam-pressure, is the "Evaporator" as it is termed. This is required to make up the supply of fresh water for

the boilers, and is generally worked by the passing of steam through coils of pipes immersed in sea-water, and so boiling it, the steam being collected and passed into the boilers with the ordinary feed-water. The immense quantities of water used are clearly given in the account of the **Teutonic's** machinery (condensed by kind permission from *The Engineer*), with some other interesting data of the various matters of fuel consumption and such-like. The other feature of special note in connection with the modern machinery is the application of forced draught, which is now being extensively adopted.[1] The two systems so far tried on the Atlantic are the closed stokehole principle, where the air is raised to a pressure in the stokehole by means of fans, and allowed to flow direct through the fires, so forcing the combustion. This principle has been extensively adopted by the various navies, but has been practically found wanting in the heavy Express Transatlantic Service.

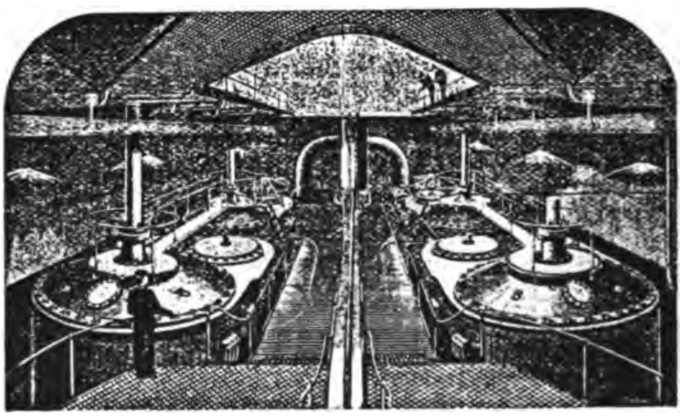
The other principle is the one named after the gentleman (Mr. Howden) who brought it forward against much opposition and prejudice, and which was first introduced to the Atlantic on the steamship **Ohio**, followed soon afterwards by the White Star Liner **Celtic.** The results on those vessels were such as to induce the fitting of it on the White Star **Teutonic** and **Majestic**, and

[1] The term forced draught is used when artificial means are adopted either by means of steam jets as on a locomotive, or by forming a partial vacuum in the funnel, or by fans blowing or forcing air into the fires. The first record of forced draught by fans is that of the famous engineer John Ericsson, who fitted it on the steamer **Corsair** in 1830, and later in the U.S. warship **Princeton** in 1843.

also more recently on the **City of Paris**, where it was fitted in lieu of the closed stokehole system, when the new machinery was fitted on board after the breakdown. Another system of artificial draught has recently been introduced which promises a further advance in the efficiency of marine boilers; it is a combination of several older forms, and practically comes under the system termed induced draught, and is now fitted and being fitted on board of several Atlantic liners.

THE MACHINERY OF TEUTONIC AND MAJESTIC.

The **Teutonic** and **Majestic** are propelled by twin-screw triple-expansion engines, indicating about 17,000 horse-power.

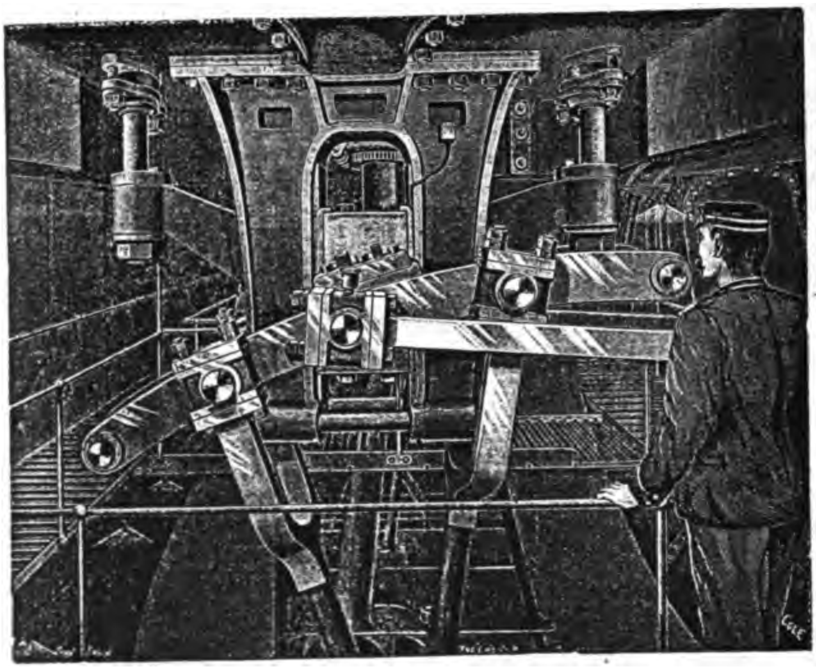


VIEW OF TOPS OF BOTH PORT AND STARBOARD ENGINES.

The cylinders are 43 inches + 68 inches + 110 inches × 60 inches. The high-pressure cylinders stand next the boiler-rooms. The engine-rooms are over 50 feet long. All the cylinders have piston valves, two each to the intermediate

and low-pressure cylinders, and one to the high-pressure cylinder. The condenser is quite separate from the engine. It is cylindrical, of brass, some 20 feet long, and 7 feet in diameter.

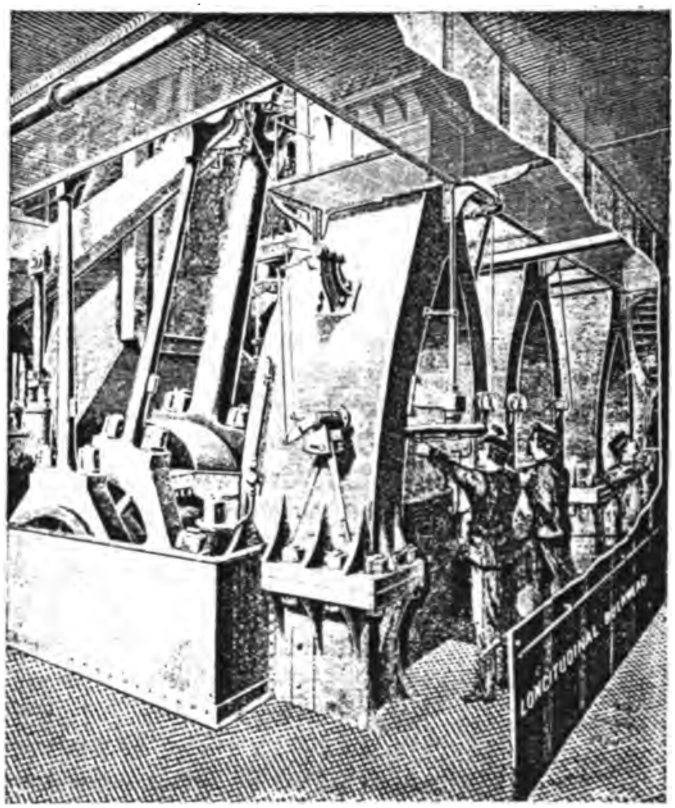
We have already explained that the screw-shafts are placed



LINK MOTION, MEDIUM CYLINDER.
STARBOARD ENGINE-ROOM.

so close together that the screws overlap 5 feet 6 inches, and the starboard propeller is astern of the other by 6 feet. The propellers revolve "outboard." A large opening is made in the dead wood to allow of this system of construction. There are no stern brackets, the hull being worked out round the

screw-shaft, and fitted with a strong spectacle casting in steel, which carries the stern bearings. There is no screw alley in the ordinary sense of the word.



STARBOARD ENGINE, LOOKING AFT FROM STOKEHOLE DOOR.

The screw propellers are 19 feet 6 inches diameter and 29 feet 6 inches pitch, three-bladed, modified Griffiths' true screws, with a surface of 108 square feet each. The propeller

blades were cast of Parsons' manganese bronze from ingots supplied by the Manganese Bronze and Brass Co., Deptford, by Messrs. Harland and Wolff, Belfast.

Steam is supplied by twelve double-ended and four single-ended boilers, containing seventy-six furnaces. The pressure is 180 lbs. They are worked with forced, or rather assisted, draught, on Howden's system.

The engines of the **Teutonic** indicate about 17,000 horse-power, sometimes of course a little less, sometimes a little more; therefore, as the power is fairly equally divided among the six cylinders, each, regarded as a distinct engine, indicates nearly 2833 horse-power. The energy transmitted to each crank-shaft is 8520 horse-power. It is far more easy to talk of 17,000 horse-power than it is to realize what its development involves. The boilers of the **Teutonic** have to produce about 120 tons of steam per hour, with an absolute pressure of 195 lbs., the safety-valve load being 180 lbs. on the square inch. Of course the feed pumps have to deliver 120 tons of water into the boilers against this pressure every hour. The feed-water required for one hour would fill a cubical tank nearly 16½ feet long, broad, and deep; for at 36 feet to the ton, 120 tons means 4320 cubic feet. The energy expended in putting this great body of water into the boilers is over 57 horse-power, allowing nothing for friction in pipes or losses of any kind. The feed pumps really absorb about 120 indicated horse-power. The total feed-water for one day of twenty-four hours amounts to 103,680 cubic feet, which would fill a cubical tank 47 feet on the side. Such a tank would hold 6,500,000 gallons; this would be an ample daily supply for a town of 26,000 inhabitants, giving every person 25 gallons per day.

The weight of steam to be condensed may, as we have said,

be taken roughly at 120 tons per hour, a quantity which gives some idea of the important part which surface condensation has played in the progress of steam navigation. About 26,000 gallons of water are made into steam at a pressure of 180 lbs. per square inch, and reconverted into water every hour. To effect this condensation about 4000 tons of sea-water are passed through the tubes of the surface condensers every hour.

The enormous distances traversed by the pistons of marine engines is never realized; at all events, we have never seen any statement of the facts in print. It suffices to give the speed in feet per minute; but no one stops to consider what this implies. In the **Teutonic** the stroke is 5 feet, and the average revolutions 78 per minute. Each piston therefore traverses 780 feet per minute, or 46,800 feet per hour, and 1,123,200 feet per day, or in six days not less than 1275 miles. In other words, more than one-third as many miles as the ship steams. The aggregate distance traversed by the three pistons is 7650 miles, or about two and a half times the distance run by the ship.

The refrigerating machinery on board the **Teutonic**, as well as that on board the sister ship **Majestic**, is on the Linde system. It is used for refrigerating the insulated meat holds, and also for the passengers' provision rooms. In the Linde system cold is produced by the evaporation under comparatively low pressure of liquid anhydrous ammonia, a liquid which possesses a boiling point at atmospheric pressure of about 37½ degrees below zero Fah. The low evaporating pressure is produced and maintained by a small pump, which draws off the vapour as quickly as it is produced, and then compresses and discharges it into a vessel, termed the condenser, in which the ammonia vapour is condensed and rendered fit for use again in the refrigerator or evaporator.

It is of course impossible to exaggerate the importance of the steering gear in a ship like the **Teutonic**. The most elaborate precautions have been taken to secure immunity from breakdowns. The arrangement is novel in design, and covered by patents secured by Messrs. Harland and Wolff. In its main features it resembles a great horizontal spur wheel, 18 feet in diameter, movable round the rudder head. This wheel is connected to a tiller, keyed on the rudder head, by arms, each of which is made up of a layer of flat springs. The object of the springs is to take up the blow of a sea, and so relieve the gear of the excessive shock to which it would otherwise be subjected. The spur wheel is worked by specially-designed steam steering engines, in duplicate. The tiller wheel and brake gear are all built up of cast steel, and, in regard to strength and workmanship, thoroughly in keeping with the rest of the ship.

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CHAPTER XI.

THE MEN WHO HAVE MADE AND CONDUCT THE ATLANTIC FERRY.

TURNING now from the general doings of the great vessels and lines, it will be interesting to recall the individuals whose names have become for ever fixed in the pages of maritime history, and of whom many have now "gone down to rest." Among the first of these was SIR SAMUEL CUNARD, the founder of the great line now bearing his name, who was born in Newfoundland in November 1787, and was there representing the great East India Company in Halifax, when he was attracted by the advertisement of the English Admiralty for the mail service across the Atlantic. Shortly afterwards (in 1838) he came to England, and having received an introduction to, he met and consulted with Mr. Robert Napier, of Glasgow, who in turn introduced him to Mr. G. Burns and Mr. David MacIver, which resulted in the line being founded and the contract signed by the three names, Samuel Cunard, George Burns, and David MacIver, and was continued by the joint firms of Cunard, Burns, and MacIver until Sir Samuel's death in London on April 28th, 1865.

Mr. George Burns, who was associated with Mr. Cunard, was born in the neighbourhood of Glasgow in the year 1795, and in 1818 commenced business as a general merchant with his brother James in Glasgow. A few years afterwards he took over a fleet of sailing coasting vessels to Liverpool and elsewhere, and commenced with steamers to Belfast in the same year, 1824. Following the usual course, steam was substituted on the Liverpool line, and a fusion made with Messrs. MacIver, of Liverpool. After the founding of the Cunard Line, Mr. George Burns resided in Glasgow, looking after the interest of the line there, and also the extensive coasting trade, and eventually retired from business in 1860, from which time up to his death he resided at Wemyss Bay, on the river Clyde. In May 1889, he was created a baronet, and died the following year on June 2nd, 1890, aged ninety-five years.

David MacIver, the other signatory to the contract with the Admiralty for carrying the mails, was born in Scotland in 1807, and was brought up in the office of the American Consul in Greenock. Together with his younger brother Charles he founded the well-known firm in Liverpool of D. and C. MacIver, which took charge of the Liverpool business of the Cunard Line, together with their other services, and was successfully carried on by them together until his death in 1845, aged only thirty-eight years.

The other great name which must be associated with this splendid enterprise was that of Mr. Robert Napier, the engineer, who practically rendered the venture a

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SIR GEORGE BURNS, BART.

BORN 1795, DIED 1890.

ONE OF TH[illegible] CUN[illegible] OINT SIGNER OF FIR[illegible]

[illegible]T.

success, as his far-seeing judgment in designing and using the best-known systems of marine engineering, prevented any breakdown or failures of machinery, which would have damaged the reputation and success of the line. He was born at Dumbarton on June 18th, 1791, and commenced business in May 1815, by purchasing a small blacksmith's shop in Glasgow. Some years afterwards, in 1823, he made his first marine engine for a

MR. ROBERT NAPIER.

INTRODUCER OF SIDE-LEVER ENGINES. BORN 1791, DIED 1876.

Clyde steamer, and continued afterwards making numerous engines for other boats down to 1839, when he made the engines for the Atlantic steamer **British Queen**, and also for the first four Cunard steamers, the connection with that firm being then formed. Amongst noted vessels engined by him was the old three-decker **Duke of Wellington**, the last of England's wooden walls; and he also built the

second of the English armour-clads, the **Black Prince**, which was engined by Penn. He died on June 22nd, 1876, aged eighty-five.

Amongst the names deserving a place on the roll of honour connected with the Transatlantic Service is that of Mr. E. K. COLLINS, the patriotic American who endeavoured in the earlier days of the trade to secure for his country a foremost place in the great steamship enterprises then just developing.

Mr. Collins was a native of Truro, Massachusetts, where he was born on August 5th, 1802. He commenced his business career at the age of fifteen, in New York City, and after a few years' service as junior, he was engaged by a firm of West Indian merchants, and was employed as purser—or, as it was then styled, supercargo—on board the vessels, where he had occasionally some exciting adventures with the numerous pirates then roving about those islands.

Some years afterwards, in 1822, he joined his father in the general shipping and commission business, and eventually became head of the firm, which he then commenced to develop extensively, first by putting fine full-rigged sailing ships on the West Indian and Mexican trade from New York; and later, in 1836, by establishing the splendid service of sailing packets between New York and Liverpool, known as the Dramatic Line, on account of all the vessels having theatrical names, such as the **Shakespeare**, **Garrick**, etc. A noted departure in these fine vessels, besides their superior internal fittings, was the total abandonment of the fine-lined vessel having a

sharp rise of floor, and the substitution for it (against the opinions of the noted New York shipbuilders) of the flat-floored form of hull.

MR. E. K. COLLINS.
FOUNDER OF THE COLLINS LINE. BORN 1802, DIED 1878.

Like the other owners of the Transatlantic sailing liners, Mr. Collins watched with keen interest the working of the earlier British Atlantic steamers, and having

satisfied himself that they would prove rivals to the sailers, he endeavoured at an early date, but without any success, to induce the United States Government to assist in promoting a line of American-built and owned steamers, so as to be available for naval service.

His early appreciation of the utility of steamers was fully shown by a conversation he had with some friends on board one of his own sailers early in 1841, when seeing the ill-fated **President** steam past, he declared "that he would do his utmost to promote a line of steamers to cross to Liverpool in ten days." But as already noted, owing to the delay of the United States Government, it was not until 1847, when the Act was passed by Congress, that he was in a position actually to commence the formation of the steamship line bearing his name, and which two years afterwards, in 1849, commenced with the **Atlantic**, **Arctic**, **Baltic**, and **Pacific**.

Upon the withdrawal of the steamers early in 1858, he turned his attention to other matters, and died in New York in January, 1878.

Mr. WILLIAM INMAN, the founder of the line which bore his name for forty-two years, was born at Leicester on April 6th, 1825, and was son of Mr. Charles Inman (a partner in the firm of Pickford and Co., the carriers), who having retired from that firm, came to Liverpool. Here his son William completed his education, and eventually became a partner in the firm of Richardson Brothers, in conjunction with whom he first promoted the steamship service, which he afterwards made so famous. This he successfully conducted until his death, in his fifty-sixth year,

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at Upton, his Cheshire residence, on July 3rd, 1881, shortly after the launch, and before the advent of, the beautiful **City of Rome**, the last vessel ordered by him.

Mr. STEPHEN BARKER GUION, the founder of the Guion Line, was of American birth, and came to Liverpool, about the year 1851, in connection with the steerage passenger trade of the Black Star Line of sailing ships, which he extensively developed. After a short connection, as agent, with the Cunard Company for the purpose of working up the steerage passenger traffic, followed by a similar connection with the National Line, he founded his own line in 1866, and successfully carried it on until shortly before his death. This took place on December 19th, 1885, in his sixty-sixth year, at Liverpool, where he was widely known and respected, having occupied several public positions with great credit and ability.

Mr. CHARLES MACIVER was born in Glasgow in the year 1811, and was early connected with his brothers in the shipping business, and on the death of his brother David he retained the sole management of the Liverpool branch of the line, which he conducted very energetically, the vessels of the Cunard Line being generally known in Liverpool as MacIver's boats. During the early days of the volunteer movement he raised a corps amongst the Cunard Line staff in Liverpool, and became colonel of it. In 1882 he retired from the line, not being in unison with his co-directors as to the future working of the concern, which was then feeling the rivalry of the other lines, and died a few years afterwards, in 1885, aged

seventy-four, at Malta, where he, for some time previously, had been in the habit of spending the winter.

SIR JOHN BURNS, Bart., of Castle Wemyss, the present Chairman of the Cunard Line, is the eldest son of the late Sir George Burns, of Wemyss Bay (page 152), and was born at Glasgow in 1829.

After going through the University of his native city, he entered the shipping office of his father's firm in Glasgow, and since that time has been directly connected with steamships.

Upon the retirement of his father in 1860 he became the life and soul of the powerful combination now known as the Cunard Line, and was appointed Chairman of it on the formation of this company in 1880, which, thanks to Sir John's energy and foresight, still maintains, from a national point of view, the great position achieved for it by the original founders.

In the shipping world Sir John is known as the author of some important papers on nautical questions, one of the best known being that on "The Adaptation of Merchant Steamers for War Purposes."

In the hours of relaxation from business, Sir John, or, as he is generally known amongst his own circle, "J. B.," is the most genial of hosts, and also takes active interest in the many benevolent institutions of the great city on the Clyde, which find in him a warm supporter, the principal being the Clyde industrial training ship, **Empress** formerly the **Cumberland**, which has more than any other institution in Scotland raised the street arabs.

SIR WILLIAM PEARCE was born at Brompton, near

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CHARLES MACIVER.

BORN 1811, DIED 1885.

Chatham, on January 8th, 1833. He was trained in the Government service at Chatham, and from there he passed to the Clyde and assumed the management of Napier's Yard; but after a few years he took a position at Fairfield, where, in 1870, in conjunction with the relatives of John Elder, then deceased, he originated the firm of John Elder and Co., of which he became sole partner in 1878. It was just prior to this that he commenced the more extensive ventures of ocean navigation with which his name has become associated, since when he has built upwards of 200,000 tons of shipping, of nearly 300,000 horse-power, and over £7,000,000 sterling in value, amongst which may be mentioned the **Arizona**, built for the Guion Company, after the model and designs of the White Star boats; and also the **Alaska** and **Oregon**, vessels that for speed were only surpassed by his later achievements, the **Etruria** and **Umbria**, and later on by the new Inman and White Star liners from the yards of other noted firms.

Concurrently with this, he constructed the entire Atlantic fleet of the North German Lloyd's, which includes seven of the fastest ocean-going continental steamers afloat.

His great capacity for work, and his ceaseless energy, coupled with exceptional powers of management, and judgment in the selection of men, have resulted in the creation of a vast ship-producing organization, which accomplished the extraordinary feat of constructing an Atlantic liner of 5000 tons in the incredibly short space of ninety-eight working days. He was elected the first

member of the newly-created constituency of the Govan Division of Lanarkshire in 1885, and again in 1886, having previously contested Glasgow in the Conservative interest in 1880. He was chairman of the Guion Steamship Company and of the Scottish Oriental Steamship Company. He was created a baronet in 1887, and died in London, December 18th, 1889.

Mr. T. H. Ismay, the founder and managing director of the White Star Line, was born at Maryport in the year 1837, and came to Liverpool, in 1852, as an apprentice to the shipping firm of Messrs. Imrie, Tomlinson and Co. On completion of his term with them, he proceeded to the west coast of South America in a sailing ship, the direct steam service then not having been established. On his return he joined, as junior partner, in 1860, the firm of P. Nelson and Co., and in 1864 became one of the directors of the National Line, then enjoying great prosperity. Afterwards, in 1866, he acquired the business of the famed White Star Line sailing fleet to Australia, having previously commenced business on his own account.

In 1869 he formed the White Star Line of steamers, and in 1870 was joined by Mr. Imrie, one of his present partners, who was son of the senior partner of the firm in whose office he served his articles. Since then he has steadily aimed at and succeeded in making his famous line of steamers the head of the great shipping concerns of Great Britain; but in 1892 he retired from the firm, although still retaining his entire interest in and position of Chairman of the Line; and he has also found time to

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James Spence

BORN 1829.

become a director of the Royal Insurance Company, and of the London and North-Western Railway Company; the Chairmanship of which was recently offered to, but declined by, him. He has also served on several Royal Commissions, on which his extensive experience proved useful.

Not the least important point of his career was the propounding of the excellent arrangements in 1878 (when the general designs and arrangements of the **Teutonic** and **Majestic** were first worked out), by which the Government was enabled, by a practicable and reasonable agreement, to directly connect the fastest steamers of all the great lines with the Royal Navy, for service in time of war, though they were not acted upon until some years later in 1887. Another pleasing record is the handing over of the sum of £20,000, as a nucleus for a fund for the support of aged and indigent merchant seamen, to commemorate the occurrence of his fiftieth birthday in the jubilee year of her Majesty, Queen Victoria, in 1887.

Mr. JAMES SPENCE, the senior and respected partner in the well-known firm of Richardson, Spence and Co., was born in the north of Ireland in 1829, and received his early training in Philadelphia, under his uncle, Mr. Clarke, who was one of the partners in the firm of Richardson, Watson and Co., of that city. This firm then owned an excellent line of packet ships, trading between that port and Liverpool, the agents or consignees in the latter port being Messrs. Richardson Brothers, which later on commenced the line now known as the Inman.

In 1854 Mr. Spence returned to England, and founded his now well-known house, in connection with Messrs. Thomas Richardson and Co., of New York and Philadelphia. In 1872 they became agents and managers in Europe for the American Steamship Company, better known as the American Line to Philadelphia, which still continues successfully under their able management.

In 1885 a further extension of his firm took place, in the acquisition of the business of the Inman Line, which had been absorbed by the International Company of America, and has since been changed to the American Line from Southampton. This important accession was mainly carried through by his partner, Mr. Edmund Taylor, who had previously been with the old firm of Richardson Brothers, and who had been associated with Mr. Spence from the commencement as manager and partner.

Besides the extensive business of his firm, Mr. Spence also finds time to devote to the important Bank of Liverpool, of which he is one of the managing directors.

SIR EDWARD JAMES HARLAND, Bart., the head of the great shipbuilding and engineering firm at Belfast, is a native of Scarborough, where he was born in 1831. After spending a few years at college in Edinburgh, he was apprenticed in 1846 to the firm of Robert Stephenson and Co., Newcastle-on-Tyne, who were extensive builders of locomotives, and also marine and land engines. Upon the completion of his articles, he entered the drawing office of Messrs. J. and G. Thomson, Glasgow, where he was engaged until 1853, when he took over the manage-

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ment of a shipbuilding yard in Newcastle-on-Tyne, belonging to Messrs. Toward. After being there for a short time, he was offered a similar post in the Belfast shipyard, then owned by Messrs. Robert Hickson and Co., which he accepted towards the end of 1854.

In the year 1858 the owner retired, and he became proprietor of the concern himself, and built his first vessel, the steamship **Venetian** (until recently the African Steamship Company's steamship **Landana**) for Messrs. Bibby, of Liverpool, which he launched early in 1859. Soon afterwards, in 1860, he was joined by his present partner, Mr. Wolff, and since then the firm has achieved world-wide fame, and gradually grown, until it is now one of the most important and extensive in the world.

In 1885 Sir Edward Harland was elected Mayor of Belfast, and had been previously for some years Chairman of the Harbour Board, and was created a baronet of the United Kingdom in the year 1885. Some time afterwards, in 1889, he was elected Member of Parliament for one of the divisions of the city.

The extensive business of which he is the head is still ably carried on by the other partners, Messrs. Wolff, Wilson and Pirrie; the two latter of whom were amongst the first pupils trained by the firm, and who have so ably and energetically conducted it as to have made the concern not only the most eminent, but also the largest and most extensive which has ever existed, the number of hands employed in 1892 reaching over 7000.

Mr. JAMES R. THOMSON, the present managing director of the great Clydebank establishment, was born in Glasgow

in the year 1844, and received his training in the shipyard of his father and uncle, James and George Thomson, then situated between Glasgow and Govan.

He joined the firm as partner in the year 1868, and has since continued to guide its course in the same satisfactory way as his predecessors, assisted by his brother, Mr. George P. Thomson.

Amongst the notable merchant vessels built by them may be mentioned the **Russia**, **Servia**, and **Aurania** for the Cunard Line; the high-speed **America** for the National Line; the **City of New York** and **City of Paris** for the Inman Line; and the **Friesland** for the Red Star Line of Antwerp.

In addition to these, this extensive establishment has of late years turned out some noted warships, such as the **Reina Regente**, **El Destructor**, **Chizoda**, and others for foreign governments; and the **Ramillies**, **Terpsichore**, **Thetis**, and others for the British Government.

Another of the noted engineers indirectly connected with the Transatlantic Trade who left their mark is Mr. JOHN ELDER, the founder of the great shipbuilding and engineering works which bore his name, but now The Fairfield Shipbuilding Company, from which so many of the Atlantic greyhounds were produced, and to whom belongs the honour of being the first to introduce successfully the compound engine. He was born at Glasgow on March 8th, 1824, and received his technical training in the works of Mr. Robert Napier, of which he afterwards became assistant manager under his father, Mr. David Elder.

In 1852 he joined the firm of Randolph Elliot and Com-

MR. JOHN ELDER.

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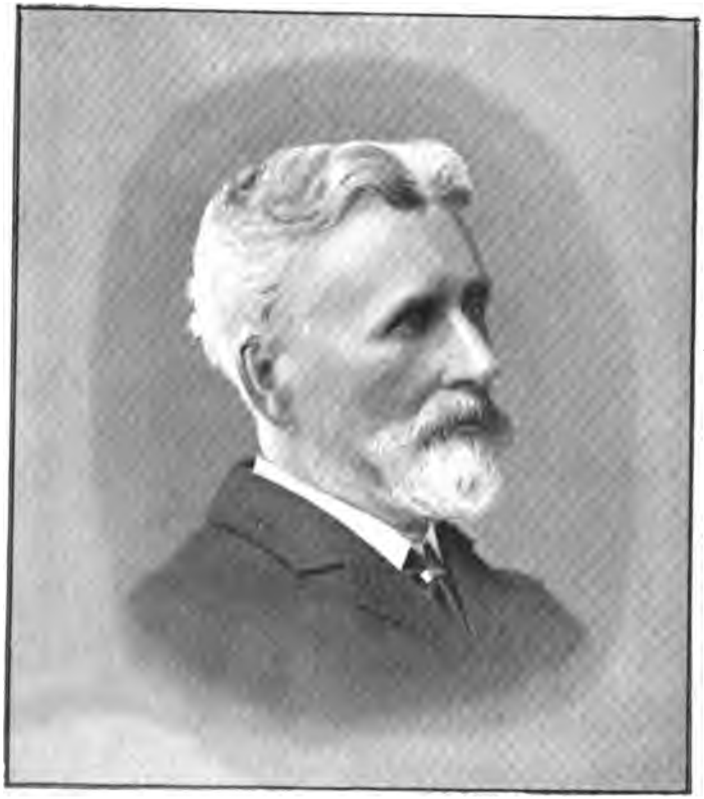
1869.



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pany, afterwards known as Randolph, Elder and Company, and constructed the first compound engine for a screw-steamer, the **Brandon**, in 1854. To this vessel belongs the credit of initiating the double expansion engine on the Atlantic Trade in the French Mail Service between Havre and New York.

In 1856 he constructed the paddle-steamer **Valparaiso**, followed at intervals by thirty vessels for the Pacific Steam Navigation Company, and the vast saving due to the compound engine demonstrated the possibility of making long voyages profitably, and led to the establishment of regular communication from Liverpool through the Straits of Magellan to the West Coast of America. In 1868 he became sole owner of the Fairfield Shipbuilding yard, changing the firm to John Elder and Company, under which style it has turned out some of the well-known vessels of to-day. He died in London in 1869, at the early age of forty-five, leaving a large fortune to his widow, who has generously applied it to promote the science of naval architecture and engineering, to which her husband personally contributed so much.

Amongst the numerous Clyde engineers who have won for themselves a distinguished position must be mentioned Mr. ALEXANDER C. KIRK, LL.D., to whom belonged the honour of having made the now universally adopted triple expansion engine a success.

Mr. Kirk was a native of Forfarshire, and was born in 1830. He received his technical training at the works of Robert Napier. Afterwards he entered the service of Messrs. Young, Meldrum and Binny in their paraffin oil

works, and when there, had his attention turned to the want of an effective means to maintain a low temperature throughout the summer months, which was required to extract the solid paraffin.

After careful study and experimenting, he eventually succeeded in producing the first successful refrigerating machine, afterwards developed by Bell, Coleman, and others.

In 1870 Messrs. John Elder and Co. appointed him manager of their engineering works, from which time he was directly connected with marine engineering. In 1874 he designed and had built the first large triple expansion engines for the steamship **Propontis**, but owing to the failure of the boilers they were not successful.

Some years later, owing to the great improvements made in the manufacture of the ordinary marine boilers, which enabled higher pressures to be carried, he again turned his attention to the triple expansion system, and in 1881 produced the steamship **Aberdeen**, which was a complete success, and was soon followed by others; so that, although triple engines had been previously made by the Ouseburn Engine Works, and the system also used by Messrs. Perkins, it is to Dr. Kirk that the credit must be given of being the first to make them a practical success. In 1877 he joined the firm of Messrs. R. Napier and Sons, Glasgow, as senior partner, which he occupied until his death, which took place rather suddenly in Glasgow on October 5th, 1892.

Another eminent name directly connected with the Atlantic Ferry was that of Mr. DAVID TOD, the principal

partner of Messrs. Tod and MacGregor, the famous shipbuilders and engineers of Glasgow; as already noted, it was Mr. Tod who induced Mr. Inman when forming his line of steamers to adopt the screw-propeller and iron hulls, the latter of which he was the first to commence building as a regular business.

Mr. Tod was born at Scone, Perthshire, and served his apprenticeship to a country wheelwright, and subsequently entered the workshop of Mr. David Napier, which turned his attention to the steamship trade.

He was engineer on board the **Rob Roy**, the first steamer to cross the Channel to Belfast in 1818, and afterwards on the other larger vessels.

After the regular commencement of the iron shipbuilding, the firm built many noted screw-steamers for the P. and O. and other lines, but more especially the Inman, for whom they built almost all the steamers, including the first **City of Paris**, **City of Brussels**, and the handsome **City of Richmond**, the latter being the last, and it is remarkable that as their shops were constructed to build the horizontal trunk engines which the line favoured, it was necessary, owing to want of height, to build the vertical engine for this vessel horizontally in their erecting-shop.

After twenty-five years of successful working Mr. Tod died at his residence at Partick, Glasgow, on the 24th January, 1859.

Of the superintending engineers who are responsible for the machinery of these great vessels, it is interesting to note that the first gentleman to occupy this important

works, and when there, had his attention turned to the want of an effective means to maintain a low temperature throughout the summer months, which was required to extract the solid paraffin.

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Mr. Tod was born at Scone, Perthshire, and served his apprenticeship to a country wheelwright, and subsequently entered the workshop of Mr. David Napier, which turned his attention to the steamship trade.

He was engineer on board the **Rob Roy**, the first steamer to cross the Channel to Belfast in 1818, and afterwards on the other larger vessels.

After the regular commencement of the iron shipbuilding, the firm built many noted screw-steamers for the P. and O. and other lines, but more especially the Inman, for whom they built almost all the steamers, including the first **City of Paris**, **City of Brussels**, and the handsome **City of Richmond**, the latter being the last, and it is remarkable that as their shops were constructed to build the horizontal trunk engines which the line favoured, it was necessary, owing to want of height, to build the vertical engine for this vessel horizontally in their erecting-shop.

After twenty-five years of successful working Mr. Tod died at his residence at Partick, Glasgow, on the 24th January, 1859.

Of the superintending engineers who are responsible for the machinery of these great vessels, it is interesting to note that the first gentleman to occupy this important

works, and when there, had his attention turned to the want of an effective means to maintain a low temperature throughout the summer months, which was required to extract the solid paraffin.

After careful study and experimenting, he eventually succeeded in producing the first successful refrigerating machine, afterwards developed by Bell, Coleman, and others.

In 1870 Messrs. John Elder and Co. appointed him manager of their engineering works, from which time he was directly connected with marine engineering. In 1874 he designed and had built the first large triple expansion engines for the steamship **Propontis**, but owing to the failure of the boilers they were not successful.

Some years later, owing to the great improvements made in the manufacture of the ordinary marine boilers, which enabled higher pressures to be carried, he again turned his attention to the triple expansion system, and in 1881 produced the steamship **Aberdeen**, which was a complete success, and was soon followed by others; so that, although triple engines had been previously made by the Ouseburn Engine Works, and the system also used by Messrs. Perkins, it is to Dr. Kirk that the credit must be given of being the first to make them a practical success. In 1877 he joined the firm of Messrs. R. Napier and Sons, Glasgow, as senior partner, which he occupied until his death, which took place rather suddenly in Glasgow on October 5th, 1892.

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Of the superintending engineers who are responsible for the machinery of these great vessels, it is interesting to note that the first gentleman to occupy this important

post in any of the regular lines was Mr. Robert Thomson, who was engineer to the Cunard Line under the *régime* of Messrs. D. and C. MacIver from the commencement, until his death in October 1871. Mr. Thomson was born at Partick, Glasgow, in 1811, and served his apprenticeship with a firm of millwrights and engineers named Graham, Wellington and Co. Afterwards he commenced his sea service on one of the early steamers, named the **Commodore**, trading between Glasgow and Liverpool, from which he joined the Cunard Line. On his death, in 1871, he was succeeded by his assistant, Mr. Logan, who occupied the position until his death in 1885. Mr. Logan was succeeded by the present superintendent engineer, Mr. James Bain, who was appointed to the post from Lloyd's Registry, in which service he was engaged as engineer surveyor. His earlier training was received at Glasgow, where he was apprenticed to Messrs. R. Napier and Co., from whence he joined the Cunard Company as sea-going engineer. Afterwards, in 1872, he joined the White Star Line, then bringing forward its new style of boats, in which he sailed as chief engineer until appointed to Lloyd's in 1875.

The first superintendent engineer of the Inman Line was Mr. Douglas Hebson, who has long been known in Liverpool, where he carried on an extensive practice as consulting engineer. After occupying the post for a few years, he resigned, and was succeeded, in the year 1864, by Mr. John Purves, who had been assisting him for some years previous. Mr. Purves was a native of Leven, Fifeshire, and received his training in the shops of Messrs. R.

and W. Hawthorn. He retired from the post in the year 1877, and was succeeded by Mr. T. F. Irwin, and died soon after at Liverpool, in 1883. After a few years Mr. Irwin, having entered into private practice as consulting engineer in Liverpool, was succeeded by Mr. George Allibon, who retained the post until his death in 1885, when the present superintendent of the line, Mr. J. S. Doran, of New York, assumed the duties, having been for some years superintendent of the Red Star Line, which at that time took over the undertaking.

The well-known superintendent engineer of the Allan Line, Mr. William Wallace, is a native of Greenock, where he received his training in the shops of the Caledonian Railway and Messrs. Caird. On completion of his apprenticeship he entered the shops of Messrs. Tulloch and Denny, of Dumbarton, and afterwards came to Liverpool to look after the engine department of the line some years after its commencement, and has since continued in the same position, where he has won for himself well-deserved reputation.

The other great line, the White Star, has its engineering department under the superintendence of Mr. S. Gordon Horsburgh, who has occupied the post almost since its creation. He is a native of Dundee, and was apprenticed in the engineering works of Messrs. J. and G. Thomson, of Clydebank, Glasgow, after leaving which he served as sea-going engineer in the service of Messrs. Bibby, of Liverpool, and was from that line appointed to his present position in 1871. Since joining this famous service he has been most successful in helping to sustain

the splendid reputation of the line, and by so discharging his onerous duties as to deserve the confidence and esteem of every one coming in contact with him.

On the commencement of the Guion Line, the charge of the engine department was placed under the superintendence of Mr. Jordan, who was responsible for the vessels during construction until after the building of the **Montana** and **Dakota**. He continued in the position until the year 1876, when he resigned, and was succeeded by the present superintendent, Mr. J. G. Hughes, since when the noted vessels **Arizona**, **Alaska**, and **Oregon** have been added to the fleet.

CHAPTER XII.

THE MANNING, EXPENSES, COST, AND RECORD OF ATLANTIC LINERS.

TURNING to the navigating of an express liner, mention must be made of the commanders, officers, and seamen who have from time to time led the van in the past, such as Judkins, Nye, Lucy, Cook, McMickan, Sir Digby Murray, Kennedy, Grace, Gleadell, Hewitt, Munroe, W. H. Thomson, Hamilton Perry, and others, whose names must be placed with those who at present maintain the same traditions of energy and daring, such as Hains, McKay, Watkins, Land, Parsell, Brooks, Murray, Randle, and others, who now possess the great honour of piloting the twenty-knotters to and fro on the Atlantic, aided by faithful and intelligent officers. Assisting these also come the carpenters, boatswains, quartermasters, A.B.'s, and others, of whom it may be truly said, that they are always ready to cope with, and if possible surmount, any difficulty or ordeal which they may be called upon to meet in the densest fogs, heaviest snow-storms, or wildest weather even of the North Atlantic.

Except by one intimately acquainted with the working and manning of an express liner, only a faint idea can

be formed of the great change which has taken place relatively in the number of hands required in the various departments; the department now requiring the fewest hands being the sailing, which in former times was of necessity the most extensive.

Now-a-days this department numbers, for a twin-screw liner, exclusive of the commander, only 50; made up of 5 officers, 2 carpenters, 2 boatswains, 6 look-out men (specially examined as to colour blindness), 6 quartermasters, 1 storekeeper, 1 lamp-trimmer, 26 seamen (A.B.'s), and 1 mess steward. These are divided into two watches, port and starboard, consisting of 2 officers, 3 look-outs, 3 quartermasters, 2 boatswains, and 13 seamen.

The staff under the chief engineer numbers 213, rated as follows:—1 senior second engineer, 1 second, 2 thirds, 2 fourths, 2 assistant seconds, 2 assistant thirds, 2 assistant fourths, 2 fifths, 2 sixths, and 2 sevenths. In addition come 3 boiler-makers, 3 electricians, 2 refrigerating engineers, 2 winchmen, 2 storekeepers, 30 greasers, 9 leading firemen, 81 firemen, and 63 trimmers. In other words, 19 engineers, 3 electricians, 3 boiler-makers, 153 stokehole staff, 30 greasers, 2 winchmen, and 2 storekeepers.

This immense staff is arranged in three watches of four hours each, as follows:—7 engineers, 8 greasers, 30 firemen, 21 trimmers, 1 electrician, and 2 electrician greasers; and has charge of about 60 different engines, large and small, inclusive of the two sets of main engines.

In the passenger and victualling departments, a staff averaging about 160 men are engaged under the purser

and chief steward, and are rated as follows:—1 second steward, 40 saloon, 20 bedroom, 8 pantrymen, 8 "boots," 20 second cabin stewards, 20 steerage stewards, 12 cooks, 6 scullions, 7 bakers, 4 butchers, 8 boys, 1 captain's steward, 2 barbers, and 4 store-keepers. This number, unlike the other departments, is, however, always varying more or less, according to the number of passengers to be carried.

Adding the totals of the three departments together, namely, 51 in the sailing, 214 in the engine, and 163 in the passenger, the large number of 428 hands are required, as a rule, in the running of these vessels, whose wages may be taken at, say £320 for the sailing department, £1280 for the engine, and £630 for the passengers, making a total of £2230 per month. When these figures are considered, together with the other heavy expenses of up-keep or maintenance, office expenses, insurance, agency commission, shore staff, works, port charges, interest on capital, and depreciation, it may be fairly taken that, at least, the sum of £25,000 is required to be realized per trip before any profit can be counted upon; so that some idea of the enormous sums at stake in the working and management of an express Transatlantic line can be realized. When these vast figures are considered, together with the very extensive requirements enumerated elsewhere, the chimerical nature of the schemes proposed from time to time for forming new lines, which promise three and four days' passage across the Atlantic, can easily be discerned; for they are overwhelming proof that the difficulties in the way of any company or firm, without shipping

experience, who would create all at once a service more luxurious, and having higher speed, than that now afforded by the existing lines, which will at the same time prove a financial success, are utterly unsurmountable.

Since this was written the **Campania** has come upon the scene, and has 100 furnaces, which are capable of consuming 450 tons of coal per day, which enables her to develop over 30,000 horse-power. This immense machinery, greater than anything existing, is not likely to propel her at a greater average speed than 22 to 22½ knots, so that she will not likely make average passages under five days.

It then becomes a question how soon will another line proceed further, as the enormous amount of money invested in one vessel (which must make some return) is such as to daunt even the largest capitalists; but as another step forward has already been made by Messrs. John Brown and Company of Sheffield, in their excellent system of induced draught, since the **Campania** was designed, there is no doubt the duration of the passage will be still further reduced.

This system of induced draught is more or less a combination of different forms of artificial draught which have been tried in the past, and has now been thoroughly tested on land and also afloat on Atlantic liners with encouraging success.

Some idea of the great advantages to be gained by such an improvement, combined with the Serve tube, may be formed when it is remembered that the number of boilers necessary to generate steam enough for 30,000 indicated

horse-power may be reduced to a little more than half, which, to put it briefly, means saving in space, weight, and first cost owing to the economy effected in the coal consumption.

As the indicated power on one of the sets of engines on a twin-screw liner now existing is greater than that ever put through a single propeller up to this date, it is evident the time is approaching when three screw-propellers will be adopted, and as this means a third set of engines on board ship, the march of future events will bo watched with intense interest.

By the coming of the **Campania** and **Lucania** it will be possible to visit New York and be back in Liverpool under a fortnight, that is, leave the latter port on Saturday, arrive in New York the following Friday, and return from thence the next day, Saturday, and arrive in Liverpool on the following Friday.

With a view of showing the immense amount of work entailed in victualling for such a large crew list, and also the immense number of passengers which are carried in the great lines, it is only necessary to reproduce the list[1] given for the **Etruria** in 1866 which is taken from the *Life of Sir George Burns*, by Edwin Hodder, and as the passenger capacity and crew lists of the more recent liners have been considerably increased since then, it is more than likely that many of the quantities given may be increased by at least 10 per cent.

[1] See Appendix.

CHAPTER XIII.

ATLANTIC RECORDS AND TABLES.

WITH a view of illustrating in a brief form the records and doings of the great lines and noted vessels during the last fifty years, the author has compiled and arranged the various tables which are to be found at the end of the book.

From a study of these tables it is interesting to form a brief synopsis of the leading features, as for instance—

The longest vessel now existing is the **Campania**.

The one having greatest displacement is the **Campania**.

The greatest displacement yet reached was 32,160 tons on the **Great Eastern**.

The greatest power indicated by paddle engines was 5000 on the **Great Eastern**.

The greatest power indicated by paddle engines on regular Transatlantic lines was 4000 on the **Scotia**.

The greatest power indicated by single-screw engines was 14,500 on the **Etruria**.

The greatest power indicated by twin-screw engines was 30,000 on the **Campania**.

The highest consumption per day attained by paddle-boat was 160 tons on the **Scotia**.

The highest consumption per day attained by screw-boat was 430 tons on the **Campania**.

The highest average speed attained by paddle-boat was 14 knots by the **Scotia**.

The highest average speed attained by screw-boat was 22·4 knots by the **Campania**.

The lowest steam-pressure carried in boilers was 12 lbs. on the **Britannia**.

The highest steam-pressure carried in boilers is 180 lbs. on the **Teutonic**.

Fastest outward passage, Queenstown to Sandy Hook (New York), 5 days, 14 hours, 24 minutes, by the **City of Paris**.

Fastest homeward passage, Sandy Hook to Roche's Point (Queenstown), 5 days, 17 hours, 37 minutes, by the **Campania**.

The various tables, which will be found at the end, serve to show the great advances made, thus—

By Tables Nos. 1 and 2 the improvement of each succeeding noted steamer may be readily seen, as in the period of 1849 to 1852 the coming of the Collins Line on the scene, with their noted vessels **Atlantic** and **Arctic**, caused the Cunard Line to advance from their then crack vessels, **Europa** and **America**, to the **Asia** and **Africa** in 1850, the **Arabia** in 1852, and afterwards to the **Persia** in 1856.

To meet the latter the Collins Line brought out the paddle-wheel **Adriatic**, in the December of 1857, but as the Company collapsed soon afterwards, she did not come to the front, although she proved very fast during the

brief period she was on the service between Galway and Halifax.

After these vessels came the Cunard **Scotia**, in 1862, prompted more by the natural expansion of the passenger and mail service than by opposition; but soon after the Inman Line began to prove formidable competitors, and eventually, in 1866, they brought out the first **City of Paris**, which made the fastest outward passage in November 1867. In the same year (1867) the Cunard screw-steamer **Russia** appeared upon the scene, and the passages of both these crack vessels became world-wide.

To meet the **Russia**, the Inman Line brought out the **City of Brussels** in 1869, which vessel made the fastest homeward passage in December of the same year.

Although the Cunard Line after this for a time practically retired from the contest for the fastest passage, a new Company appeared upon the scene in the White Star Line, who, to outstrip the **City of Brussels**, produced the **Oceanic** and sister vessels, one of which, the iron screw **Adriatic**, made the fastest outward run in May 1872, and another, the **Baltic**, the homeward run in January 1873.

The effect of this was the coming of the Inman liners **City of Chester**, 1873; **City of Richmond**, 1874; and **City of Berlin** in 1875, the latter of which succeeded in making the fastest outward and homeward runs in September and October 1875. These were, however, regained by the White Star Line, in February and November 1876, by the **Germanic** and **Britannic**.

After these dates there occurred a spell during which no more vessels were brought out until 1879, when the

Guion Line, to surpass these two vessels, brought out the **Arizona**, which beat the record outward in May 1880, and homeward in July 1879.

In 1881 the Inman Line made an attempt to get the front rank again by bringing out the **City of Rome**, but were unsuccessful.

To excel the **Arizona** the Guion Line produced the **Alaska** and **Oregon**, both of which made record passages.

The doings of these vessels brought out the **America** for the National Line, from the firm which had hitherto built the Cunard vessels, and in June 1884, she attained the homeward record.

To outstrip these performances the Cunard Line in 1884 produced the **Umbria**, and in 1885 the **Etruria**, both of which vessels lowered the record, both outward and homeward.

After these two vessels appeared there was an interval until 1888, when to outstrip them and to regain their former position on the "Ferry," the Inman Company, as reorganized, brought out the twin-screws **City of New York** and **City of Paris**, which won the foremost position outward and homeward in 1889.

To keep pace with these vessels, the White Star **Teutonic** and **Majestic** appeared upon the scene, and won the outward and homeward records in 1891, but have again yielded them to the two Cities, which, by the way, are now no longer known by the prefix **City**.

As was only to be expected, the doings of these vessels are now surpassed by the Cunard Company, who have specially brought out the **Campania** and **Lucania**, built

with the successful innovations of the Inman and White Star boats, and considerably greater engine power, which ensured their making the fastest passages.

With a view of making a comparison, the following account of the doings of the various sailing ship lines in 1840, taken from the *Liverpool Mercury* of June 26th in that year, will be of interest—

Extract from "Liverpool Mercury," June 26th, 1840.

PASSAGES OF SAILING VESSELS.

Name of Line.	To England.			To New York.		
	No. of Voyages.	Time on Passage.	Fastest Passage.	No. of Voyages.	Time on Passage.	Fastest Passage.
Old Black Ball Line	23	22¼ days	18 days	23	33¾ days	22 days
Dramatic Line[1]	11	20½ „	17 „	12	33½ „	23 „
Star Line	11	24 „	21 „	11	39 „	27 „
Swallow Tail Line	11	22½ „	17 „	11	35 „	28 „

STEAMERS.

Great Western		13¾ days	12¼ days		16¼ days	13 days
Liverpool[2]		15¾ „	13¾ „		17½ „	16 „

From this it will be seen the best average passages outward to New York were 33½ days by the Dramatic Line clippers, the fastest passage being 22 days, made by the old Black Ball Line.

For the homeward trip, the best average passages were those of the Dramatic Line, being 20½ days, the fastest

[1] See life of E. K. Collins, p. 154.

[2] The **Liverpool** had eighteen hours' farther steaming than the **Great Western**.

passage being made by their vessels and also those of the Swallow Tail Line in 17 days. The time occupied by the only two regular steamers, the **Great Western** and **Liverpool**, is also of interest, as showing the speeds then attained, and which may be continued down to the present day by reference to the Tables Nos. 4 and 5, which show the average passages made by the various steam lines since 1850. The next table, No. 6, the author has compiled from reliable sources for the purpose of showing the average passages which may be expected to prevail in the Express Transatlantic Service before many years have passed, as there is no doubt each of the great lines will sooner or later be compelled to increase the number of their high-speed vessels from two to at least four. By the table it will be seen that the averages for the two fastest vessels of each line have been for the year 1892 as follows—

	Outward.			Homeward.		
	d.	h.	m.	d.	h.	m.
Cunard **Umbria** and **Etruria** . . .	6	8	2	6	9	21
Inman **City of New York** and **City of Paris**	6	1	2	6	11	50
White Star **Teutonic** and **Majestic** . .	6	2	36	6	6	25

which practically ensures a future regular average passage outward and homeward of about six days. Taking the distance generally travelled between Queenstown and Sandy Hook as averaging about 2800 knots outward, and 2840 homeward, these results indicate a mean average speed of 18¾ knots outward, and 19 knots homeward, which is but little below the maximum speed attained.

As an instance of how much will be required to obtain even a little improvement, it will be interesting to follow the changes necessary, as shown by the following estimate,

which is based upon moderate improvements in the existing forms of ships and machinery. If we take for example the **Teutonic** and **Majestic** (whose models, as in the case of the earlier White Star boats, notably the **Britannic** and **Germanic**, seemed to serve them in good stead), to attain their present speed of 20 knots, requires about 17,000 indicated horse-power each, which means (allowing enough for all the auxiliary engines) a consumption of, in round figures, 300 tons per day of 24 hours, or say 1·6 lbs. per indicated horse-power per hour. Assuming that the consumption may, by advancing improvements, be reduced to 1¼ lbs. per hour, and that the size of the machinery be so increased as to admit of a daily consumption of 500 tons per day, which would mean engines powerful enough to indicate 47,000 horse-power, or say, two sets indicating nearly 23,500 each, or three sets of nearly 16,000 each, then, assuming this will give an average speed of 24 knots per hour, the reduction in the time occupied in making the passage will be some 20 hours, so that the coming vessel, to ensure a passage of less than five days across the Atlantic, will require to indicate over 46,000 horse-power, and consume about 500 tons of coal per day, which will mean an increase in the engine-room staff to over 22 hands.

Up to the present time the greatest distance run in one day of 24¾ hours has been 530 knots, equal to 610 miles, which was achieved by the Inman and International **City of Paris** on an outward passage in October 1892. This gives a rate of 21·4 knots, or over 24½ statute miles per hour, but it is more than probable this speed will soon be advanced by the **Campania** or **Lucania** to 22½ knots per hour, which,

if maintained all the way across the Atlantic, would mean a passage of 5 days, 3 hours, that is, leave Queenstown at noon on Sunday, and arrive in New York before noon the following Friday.[1]

The last table, No. 7, which remains to be commented upon, contains in brief a record of the various steamships which have succumbed to the perils of the deep, and, in some instances, left sad memories of friends and relations swallowed up by the great sea, and in others of deeds of indomitable courage and daring (such as the rescue of every life from off the **Danmark**), greater and more heroic than any which have ever earned the distinction of the Victoria Cross amid the clash of arms, because they have been effected under more thrilling circumstances, and in a higher and nobler cause.

Out of the 122 vessels lost, it will be noticed 63 caused loss of life either directly or indirectly, and it is a matter of great congratulation to notice that not a single life has up to the present been lost by any casualty to the great express liners, a fact which must be largely attributed to the effective bulkhead division now in vogue, as illustrated by the **Oregon** disaster and the **City of Paris** breakdown.

Of the other vessels, it will be noticed that 25 were never heard of after leaving port, so that no definite reason can be assigned for their loss; the first to figure under this heading being the unfortunate **President** in 1841.

Of the others, 54 were wrecked, 15 foundered, 9 were

[1] In May 1893 the Cunard **Campania** ran 517 knots on homeward passage in a day of 23 hrs. 10 min., which is equal to 554½ knots on outward passage, or 623 statute miles per day.

burned, 5 sunk by ice, and 16 sunk by collision, which last has so far been the only one in this unfortunate category of maritime dangers to claim as a victim one of the swift ships of the great express trade.

In concluding this description and retrospect of the past fifty years of the working and management of the great North Atlantic lines of steamships, it will not be out of place to take a look into the future and see what may yet be in store for posterity, as it would be idle to deny that there is any finality in such matters; and so long as the travelling public demand and will pay for yet higher degrees of comfort and speed, new vessels will be brought forward, possessing still further improvements, as every effort which skill and science can command will be put forward, by the great shipbuilding firms, to produce something in advance of their preceding achievements. What the nature of the advances will be it is difficult to surmise, as of course every step forward reduces the field for further improvements and extension; and although it is quite possible to reduce the time now occupied by merely increasing the power of the machinery, and of necessity the present enormous daily consumption of coal, it is plainly evident that the speeds now attained by the "Fleet Messengers of the Mersey" are fast reaching the same condition as the speeds of the express trains, which have been for many years past at a standstill, the maximum speed of to-day on the railways being but little, if any, more than that attained many years ago.

To one who has made a study or understands this ever-developing steamship trade, it is plainly evident that

whether the improvements be in the ship or machinery, gradual advances will be made in the near future, and so long as the desire to shorten the duration of ocean voyages and competition exists, shipowners, engineers, and builders will be prepared to advance beyond anything yet achieved, if even moderate financial success can be counted upon and the premier position maintained.

TABLES

AND

APPENDIX.

TABLES

AND

APPENDIX.

TABLE No. 1.—Dimensions, etc., of Famous Atlantic Steamers.

Name of Ship.	Owners.	Where built.	Year.	Ship's Dimensions. Length.		Breadth.	Depth.	Tonnage.	Displacement.	Engine Dimensions. Cylinders.	Stroke.		Pressure.	Indicated power.	Speed per hour.	No. of boilers.	Furnaces.	Type of engine.	How propelled.	Remarks.
				Over.	B.P.	ft.	ft.		tons	Num. Dia.	ft.	in.	lbs.							
Savannah	Colonel Stevens	New York	1819	145	130	26	16·5	600	1,850	1 of 40	5	0	10	90	6	-	-	Inclined direct-acting	Paddles	Wrecked, 1822.
Royal William	C. of Dublin Co.	Liverpool	1838	175	145	27	17·5	720	1,980	2 of 48½	5	6	5	400	7	2	8	Side-lever	,,	Broken up, 1888.
Sirius	Brit. and Amer. Steam Navig. Co.	Leith	1838	200	178	25·5	18·25	703	1,995	2 of 60	6	0	15	600	8½	2	8	,,	,,	Wrecked, 1847.
Great Western	G. W. S. S. Co.	Bristol	1838	236	212	35·3	23·1	1,340	2,300	2 of 73½	7	0	15	750	8½	4	12	,,	,,	Broken up, 1856.
British Queen	Brit. and Amer. Steam Navig. Co.	London	1839	295	275	37·5	27	1,863	2,970	2 of 71½	7	0	15	700	8	4	12	Side-lever	Paddles	Sold foreign, 1841.
Britannia	Cunard	Greenock	1840	250	230	34·5	22·5	1,150	2,050	2 of 82½	6	10	12	740	8½	4	12	,,	,,	Sold, 1852.
Great Britain	Great Western	Bristol	1843	324	274	48·2	31·5	3,270	5,780	4 of 88	6	0	25	1,500	11	6	24	Chain-gearing	Screw	Hulk, 1890.
America	Cunard	Greenock	1848	270	251	38	25·3	1,825	4,250	2 of 82½	6	10	13	1,200	10¼	4	16	Side-lever	Paddles	Sold, 1860.
Asia	Cunard	Greenock	1850	290	268	45	24	2,227	3,620	2 of 96	10	0	15	2,000	11½	4	24	Side-lever	Paddles	Sold, 1860.
Arctic	Collins	New York	1850	300	282	45	31·5	2,860	6,200	2 of 96	10	0	17	2,000	11¾	4	32	,,	,,	Sunk, 1856.
Persia	Cunard	Glasgow	1855	390	360	45	29·9	3,300	7,130	2 of 100½	10	0	20	3,600	12½	8	40	,,	,,	Sold, 1868.
Adriatic	Collins	New York	1857	380	355	50	33	3,670	7,960	2 of 100	12	0	20	3,600	13	6	48	Oscill. cylinder	,,	Hulk, 1863.
Great Eastern	G. E. S. S. Co.	Millwall	1858	691	680	82·8	48·2	18,915	32,160	4 of 74	14	6	25	5,000	–	4	40	Oscillating	Paddles	Broken up, 1891.
										4 of 84	4	0	25	6,000	13	6	60	Horiz. D. A.	Screw	
Scotia	Cunard	Glasgow	1862	400	370	47·8	30·5	3,871	7,600	2 of 100	12	0	25	4,000	13½	8	40	Side-lever	Paddles	Sold, 1875.
City of Paris	Inman	Do.	1866	359	346	40·4	26·2	2,651	6,411	2 of 89	3	6	30	2,600	13½	8	24	Horiz. trunk direct-acting	Screw	Sold, 1883.
Russia	Cunard	Do.	1867	383	370	43	28·8	2,959	6,770	2 of 85	4	0	25	2,500	13½	4	28	Inverted D. A.	,,	Sold, 1881.
City of Brussels	Inman	Glasgow	1869	415	390	40·3	27·1	3,081	6,900	2 of 90	4	6	30	3,000	14½	8	24	Horizon. Trunk	Screw	Sunk, 1888.
Oceanic	White Star	Belfast	1871	432	420	41	31	3,707	7,240	2 of 41 2 of 78	5	0	65	3,000	14¾	10	20	Compound tandem	,,	—
City of Richmond	Inman	Glasgow	1874	468	441	43·5	34	4,780	9,320	1 of 68 1 of 120	5	0	70	4,000	15	10	30	Compound	,,	Sold, 1891.
Britannic	White Star	Belfast	1874	468	455	45·2	33·7	5,004	9,600	2 of 48 2 of 83	5	0	75	5,100	16	8	32	Compound tandem	,,	—
City of Berlin	Inman	Greenock	1875	520	489	44	35	5,491	10,100	1 of 72 1 of 120	5	6	75	5,200	16	12	36	2-crank compound	Screw	—
Arizona	Guion	Glasgow	1879	475	450·2	45·4	35·7	5,147	9,900	1 of 62 2 of 90	5	6	90	6,300	16¼	7	39	3-crank compound	,,	—

TABLE No. 1—*continued.*

Name of Ship.	Owners.	Where built.	Year.	Ship's Dimensions. Length. Over.	Length. B.P.	Breadth.	Depth.	Tonnage.	Displacement.	Engine Dimensions. Cylinders.	Stroke.	Pressure.	Indicated power.	Speed per hour.	No. of boilers.	Furnaces.	Type of engine.	How propelled.	Remarks.
						ft.	ft.		tons.	Num. Dia.	ft. in.	lbs.							
Servia	Cunard	Glasgow	1881	532	515	52·1	37·9	8,500	12,300	1 of 72 2 of 100	6 6	90	10,000	16½	7	39	3-crank compound	Screw	—
City of Rome . .	Inman	Barrow	1881	600	560·2	52·3	37	8,144	13,500	3 of 46 3 of 86	6 0	90	11,500	17½	8	48	Tandem 3-crank compound	,,	—
Alaska	Guion	Glasgow	1881	520	500	50	38	6,400	9,500	1 of 68 2 of 100	6 0	100	11,000	17¾	9	54	3-crank compound	,,	—
Notting Hill . .	Twin Screw	Do.	1881	435	420	45·1	26·5	3,920	6,210	2 of 32½ 2 of 76	4 0	100	2,800	12	3	18	Tandem single-crank com.	Twin screw	—
Aurania . . .	Cunard	Glasgow	1882	485	470	52·2	37·3	7,269	13,360	1 of 68 2 of 91	6 0	90	8,500	17½	7	39	3-crank compound	Single screw	—
Oregon	Guion & Cunard	Do.	1883	520	501	54·2	40	7,375	12,500	1 of 70 2 of 104	6 0	110	13,000	19	9	72	,,	,,	Sunk, 1886.
America . . .	National	Do.	1884	459	432	51·3	38·6	5,528	9,550	1 of 63 2 of 91	5 6	95	9,500	18¾	7	39	,,	,,	Sold, 1886.
Etruria . . .	Cunard	Do.	1885	520	501	57·3	38·2	7,718	13,300	1 of 71 2 of 105	6 0	110	14,500	19½	9	72	,,	,,	—
Aller	North German	Glasgow	1886	455	438	48	34·6	5,400	10,460	1 of 44 1 of 70 1 of 108	6 0	150	7,974	16½	6	36	3-crank triple	Single screw	—
City of Paris [1]	Inman	Do.	1889	560	527·6	63·2	39·2	10,500	17,270	2 of 45 2 of 71 2 of 113	5 0	150	18,500	20	9	54	,,	Twin Screw	—
Teutonic . . .	White Star	Belfast	1889	582	566	57·8	39·2	9,686	16,740	2 of 43 2 of 68 2 of 110	5 0	180	17,500	20	16	76	,,	,,	—
Fürst Bismarck	Hamburg American	Stettin	1890	520	502·6	57·6	38	8,874	15,200	2 of 43½ 2 of 67 2 of 106½	5 3	160	17,000	19½	9	72	,,	,,	—
La Touraine .	Co. Gen. Transatlantique	S. Nazaire	1891	540	520·2	56	34·6	9,209	14,920	2 of 41 2 of 60½ 2 of 100	5 5⅝	160	16,000	19	9	45	3-crank triple	Twin screw	—
Campania . . .	Cunard	Glasgow	1893	620	598	65	43	12,950	21,000	4 of 37 2 of 79 4 of 98	5 9	165	30,000	22	13	100	Tandem triple	,,	—

[1] Now American Line, Paris.

TABLE No. 2.

RAPID PASSAGES MADE BY ATLANTIC STEAMERS, 1840 TO 1891.

Outward.

Year.	Month.	Name.	Owner.		From	To.	Distance, knots.	Time occupied. D.	H.	M.	Average speed per hour.
1840	July	**Britannia**	Cunard Line.		Liverpool	Boston	2755	14	8	0	8
1840	August	**Acadia**	Do.		Do.	Halifax	2487	11	4	0	9¼
1848		**Europa**	Do.		Do.	New York	3047	11	3	0	11¼
1851	August	**Baltic**	Collins	,,	Do.	Do.	3054	9	18	0	13¼
1857	June	**Persia**	Cunard	,,	Do.	Do.	3070	9	13	41	13
1864		**Scotia**	Do.		Queenstown	Do.	2783	8	15	45	13½
1866	July	**Do.**	Do.		Do.	Do.	2851	8	4	34	14
1867	November	**City of Paris**[1]	Inman	,,	Do.	Do.	2700	8	4	1	13¾
1872	May	**Adriatic**	White Star	,,	Do.	Do.	2778	7	23	17	14½
1875	September	**City of Berlin**	Inman	,,	Do.	Do.	2829	7	18	2	15
1876	November	**Britannic**	White Star	,,	Do.	Do.	2795	7	13	11	15¼
1877	April	**Germanic**	Do.		Do.	Do.	2830	7	11	37	15½
1877	August	**Britannic**	Do.		Do.	Do.	2802	7	10	53	15¼
1880	May	**Arizona**	Guion	,,	Do.	Do.	2761	7	10	47	15¼
1882	April	**Alaska**	Do.		Do.	Do.	2803	7	6	43	16
1884	August	**Oregon**	Do.		Do.	Do.	2792	6	9	42	19¼
1885	May	**Etruria**	Cunard	,,	Do.	Do.	2821	6	5	31	19
1887	May	**Umbria**	Do.		Do.	Do.	2810	6	4	42	19¼
1888	May	**Etruria**	Do.		Do.	Do.	2855	6	1	55	19½
1889	September	**City of Paris**[2]	Inman	,,	Do.	Do.	2788	5	19	18	20
1891	August	**Teutonic**	White Star	,,	Do.	Do.	2778	5	16	31	20½
1892	October	**City of Paris**	Inman	,,	Do.	Do.	2782	5	14	24	21

[1] First City of Paris. [2] Second City of Paris.

TABLE No. 3.

RAPID PASSAGES MADE BY ATLANTIC STEAMERS, FROM 1840 TO 1892.

Homeward.

Year.	Month.	Name.	Owner.	From	To	Distance, knots.	Time occupied. D.	H.	M.	Average speed per hour.
1841	July	**Britannia**	Cunard Line.	Halifax	Liverpool	2573	10	0	0	$10\frac{1}{4}$
1841	Do.	**Acadia**	Do.	Do.	Do.	2534	9	21	0	$10\frac{3}{4}$
1851	May	**Pacific**	Collins ,,	New York	Do.	3078	9	20	26	13
1852	February	**Atlantic**	Do.	Do.	Queenstown	2712	9	17	15	$11\frac{1}{2}$
1856		**Persia**	Cunard ,,	Do.	Do.	2732	9	1	45	$12\frac{1}{2}$
1863	December	**Scotia**	Do.	Do.	Do.	2731	8	3	0	14
1869	Do.	**City of Brussels**	Inman ,,	Do.	Do.	2786	7	22	3	$14\frac{1}{2}$
1873	January	**Baltic**	White Star ,,	Do.	Do.	2843	7	20	9	15
1875	October	**City of Berlin**	Inman ,,	Do.	Do.	2820	7	15	28	$15\frac{1}{4}$
1876	February	**Germanic**	White Star ,,	Do.	Do.	2894	7	15	17	$15\frac{3}{4}$
1876	December	**Britannic**	Do.	Do.	Do.	2882	7	12	47	16
1879	July	**Arizona**	Guion ,,	Do.	Do.	2810	7	8	11	16
1882	June	**Alaska**	Do.	Do.	Do.	2791	6	22	0	$16\frac{3}{4}$
1884	Do.	**America**	National ,,	Do.	Do.	2815	6	14	8	$17\frac{1}{2}$
1884	August	**Oregon**	Guion ,,	Do.	Do.	2853	6	11	9	$18\frac{1}{4}$
1887	March	**Etruria**	Cunard ,,	Do.	Do.	2890	6	4	36	$19\frac{1}{2}$
1889	May	**City of Paris**	Inman ,,	Do.	Do.	2894	6	0	29	20
1889	August	**Do.**	Do.	Do.	Do.	2792	5	23	38	$19\frac{3}{4}$
1889	December	**Do.**	Do.	Do.	Do.	2784	5	22	50	$19\frac{3}{4}$
1891	October	**Teutonic**	White Star ,,	Do.	Do.	2790	5	21	3	$19\frac{3}{4}$
1892	August	**City of New York**	Inman ,,	Do.	Do.	2814	5	19	57	20
1893	May	**Campania**	Cunard ,,	Do.	Do.	2828	5	17	27	$20\frac{1}{2}$

TABLE No. 4.

Average Passages of Steamships of Atlantic Lines from 1850 to 1892.

Outward.

Year.	Cunard.			Inman.			Union.			White Star.		
	D.	H.	M.	D.	H.	M.	D.	H.	M.	D.	H.	M.
1850	13	0	0		—			—			—	
1852	12	19	26		—			—			—	
1855	12	12	0		—			—			—	
1866	10	11	34	11	15	18		—			—	
1873	10	16	40	10	22	4	12	6	38	9	19	48
1875	10	17	24	10	20	45	11	8	47	9	16	33
1876	10	13	32	10	1	44	10	23	45	8	21	14
1877	10	5	23	9	7	21	10	3	30	8	18	27
1878	9	22	27	9	4	15	9	20	1	8	15	39
1879	9	23	48	9	12	6	9	20	40	8	21	12
1880	9	22	12	9	10	45	9	16	50	8	23	12
1881	10	6	29	9	12	52	9	23	55	8	21	40
1882	9	17	39	10	0	45	9	10	41	9	0	18
1883	9	11	15	9	17	3	9	9	5	8	20	29
1884	9	11	15	9	20	3	9	9	5	8	20	29
1885	8	0	54	9	13	42	9	18	23	8	16	22
1886	7	11	10	9	11	32	9	3	27	8	16	15
1887	7	10	38	9	23	37	8	22	43	8	14	4
1888	7	8	5	9	2	44	9	1	2	8	12	45
1889	7	10	30	8	3	28	9	6	51	8	7	27
1890	7	15	23	8	16	9	9	14	34	7	17	0
1891	7	4	22	7	21	11	9	4	38	7	5	25
1892	7	0	38	7	15	9	9	10	22	7	3	34

TABLE No. 5.

AVERAGE PASSAGES OF STEAMSHIPS OF ATLANTIC LINES FROM 1850 TO 1892.

Homeward.

Year.	Cunard.			Inman.			Guion.			White Star.		
	D.	H.	M.	D.	H.	M.	D.	H.	M.	D.	H.	M.
1850	12	16	0									
1855	11	12	0									
1866	9	4	39	10	11	40						
1873	9	7	59	10	0	2	10	20	18	8	22	39
1876	9	4	48	8	17	52	9	20	4	8	12	13
1877	9	5	59	8	21	51	9	12	54	8	11	9
1878	9	8	37	9	0	3	9	18	50	8	16	19
1879	9	3	26	8	22	33	9	9	46	8	10	32
1880	9	6	58	9	1	59	9	9	9	8	17	26
1881	9	9	29	9	2	18	9	11	14	8	13	54
1882	8	20	17	9	2	21	8	16	20	8	10	50
1883	8	20	46	9	2	55	8	13	1	8	11	6
1884	9	2	14	9	7	37	8	22	6	8	13	21
1885	7	14	36	9	2	19	9	5	34	8	6	44
1886	7	3	29	9	2	18	8	18	52	8	6	42
1887	7	5	46	9	8	6	8	15	10	8	5	9
1888	7	0	31	8	18	5	8	15	47	8	3	46
1889	7	2	40	7	23	23	8	14	1	7	22	7
1890	7	4	52	8	6	37	8	20	6	7	6	16
1891	6	23	23	7	16	47	9	4	38	7	0	48
1892	7	1	0	7	12	36	9	10	33	7	1	30

TABLE No. 6.

Average Passages of the Two Fastest Steamers of each Line.

Outward.

Year.	Cunard.			Inman.			White Star.		
	D.	H.	M.	D.	H.	M.	D.	H.	M.
1889	6	20	33	6	11	26	6	11	29
1890	6	18	10	6	6	4	6	5	0
1891	6	11	50	6	6	4	6	2	30
1892	6	8	2	6	1	2	6	2	36

Homeward.

1889	6	18	8	6	9	56	6	11	21
1890	6	12	22	6	9	30	6	7	30
1891	6	10	20	6	8	24	6	8	50
1892	6	9	21	6	11	50	6	6	25

Fastest Passages yet made by the Fastest Steamer of each Line.

Outward.

Year.	Month.	Steamer.	Line.	D. H. M.
1892	May	**Etruria**	Cunard	6 0 20
1891	August	**Teutonic**	White Star	5 16 31
1892	October	**City of Paris**	Inman	5 14 24

Homeward.

1888	November	**Umbria**	Cunard	6 3 17
1892	August	**City of New York**	Inman	5 22 50
1891	October	**Teutonic**	White Star	5 21 3

TABLE No. 7.

List of Steamships and Number of Lives Lost in Atlantic Trade from 1840 to 1893.

Year.	Month.	No.	Name of vessel.	Owners.	Nationality.	No. of lives lost.	How lost.	Where.
1841	March 11	1	**President**	Brit. and Amer. S. N. Co.	British	136	Never heard of	
1843	July 1	2	**Columbia**	Cunard Line	Do.	None	Wrecked	
1850	Nov.	3	**Helen Sloman**		German	9		
1852	Dec. 24	4	**St. George**		British	51	Burned	
1853	Dec. 5	5	**Humboldt**	New York and Havre S.	American	1	Wrecked	Halifax
1854	March 1	6	**City of Glasgow**	Inman Line	British	480	Never heard of	
1854	July 17	7	**Franklin**	New York and Havre S. In. Co.	American	None		Long Island
1854	Sept. 9	8	**City of Philadelphia**	Inman Line	British	Do.	Wrecked	Cape Race
1854	Sept. 27	9	**Arctic**	Collins Line	American	322	Collision	At sea
1856	June 29	10	**St. Denis**	French	French	46	Wrecked	
1856	Sept. 23	11	**Pacific**	Collins Line	American	240	Never heard of	
1856	Nov. 2	12	**Le Lyonnais**	French	French	120	Collision	Nantucket
1857	Feb. 26	13	**Tempest**	Anchor Line	British	150	Never heard of	
1857	June 1	14	**Canadian**	Allan Line	Do.	None	Wrecked	
1858	June 13	15	**New York**	Glas. and New York S. Co.	Do.	Do.	Do.	Mull of Kintyre
1858	Sept. 13	16	**Austria**	Hamburg-American Line	German	470	Burned	At sea
1859	June 28	17	**Argo**	Galway Line	British	None	Wrecked	Newfoundland
1859	Nov. 21	18	**Indian**	Allan Line	Do.	27	Do.	Nova Scotia
1860	Feb. 20	19	**Hungarian**	Do.	Do.	237	Do.	Sable Island
1860	Oct. 7	20	**Connaught**	Galway Line	Do.	None	Burned	Massachusetts
1861	June 4	21	**Canadian**	Allan Line	Do.	35	Coll. with iceberg	Straits of Belleisle
1861	Nov. 5	22	**North Briton**	Do.	Do.	None	Wrecked	Paraquet Island
1863	April 27	23	**Anglo-Saxon**	Do.	Do.	237	Do.	Cape Race
1863	June 14	24	**Norwegian**	Do.	Do.	None	Do.	St. Paul Island

TABLE No. 7—*continued.*

Year.	Month.	No.	Name of vessel.	Owners.	Nationality.	No. of lives lost.	How lost.	Where.
1863	Aug. 4	25	Georgia	National Line	British	None	Wrecked	Sable Island
1864	Feb. 22	26	Bohemian	Allan Line	Do.	20	Do.	Cape Elizabeth
1864	March 29	27	City of New York	Inman Line	Do.	None	Do.	Daunts Rck, Qnstown
1864	Nov. 3	28	Jura	Chartered by Allan Line	Do.	Do.	Do.	Near Liverpool
1864	Dec. 10	29	Iowa	London Line	Do.	Do.	Do.	Cherbourg
1865	July 31	30	Glasgow	Inman Line	Do.	Do.	Burned	Nantucket
1866	Dec. 1	31	Scotland	National Line	Do.	Do.	Collision	At sea
1868	January	32	Chicago	Guion Line	Do.	Do.	Wrecked	Daunts Rck, Qnstown
1868	April 17	33	United Kingdom	Anchor Line	Do.	80	Never heard of	
1868	Nov. 25	34	Hibernia	Do.	Do.	66	Foundered	
1869	Aug. 7	35	Germania	Hamburg-American Line	German	None	Wrecked	Cape Race
1869	Aug. 8	36	Cleopatra	Canadian Line	British	Do.	Lost in fog	Newfoundland
1870	Jan. 28	37	City of Boston	Inman Line	Do.	177	Never heard of	
1870	Oct. 19	38	Cambria	Anchor Line	Do.	190	Wrecked	N. W. coast of Ireland
1872	April 7	39	Dacian	Allan Line	Do.	None	Do.	Halifax
1872	Oct. 8	40	Scanderia	Anglo-Egyptian Line	Do.	38	Never heard of	
1872	Dec. 3	41	Germany	Allan Line	Do.	30	Wrecked	Near Bordeaux
1873	Jan. 27	42	Britannia	Anchor Line	Do.	None	Do.	Arran Island
1873	April 1	43	Atlantic	Oceanic S. N. Co.	Do.	585	Do.	Near Halifax
1873	May 17	44	Tripoli	Cunard Line	Do.	None	Do.	Tuskar Rock
1873	July 7	45	City of Washington	Inman Line	Do.	Do.	Do.	Nova Scotia
1873	Sept. 27	46	Ismailia	Anchor Line	Do.	52	Never heard of	
1873	Oct. 1	47	Missouri	Dominion Line	Do.	None	Wrecked	Bahamas
1873	Nov. 22	48	Ville de Havre	Transatlantique Line	French	226	Collision	At sea
1873	Dec.	49	Colorado	Guion Line	British	6	Do.	River Mersey
1874	April 3	50	Europe	Transatlantique Line	French	None	Foundered	At sea
1875	May 7	51	Schiller	Eagle Line	German	312	Wrecked	Scilly Islands
1875	June 2	52	Vicksburg	Dominion Line	British	47	Coll. with iceberg	Off Newfoundland

TABLE No. 7—*continued.*

Year.	Month.	No.	Name of vessel.	Owners.	Nationality.	No. of lives lost.	How lost.	Where.
1875	June 19	53	**Abbotsford**	Chartered by Amer. Line	British	None	Wrecked	Anglesea
1876	Dec. 6	54	**Deutschland**	Norddeutscher Line	German	52	Do.	Goodwin Sands
1877	Jan.	55	**Colombo**	Wilson Line	British	44	Never heard of	
1877	Feb. 6	56	**Bavaria**	Dominion Line	Do.	None	Burned	At sea
1877	March 17	57	**Rusland**	Red Star Line	Belgian	Do.	Wrecked	Long Island
1877	May	58	**Dakota**	Guion Line	British	Do.	Do.	North Wales
1878	June 1	59	**Idaho**	Do.	Do.	Do.	Do.	Coast of Wexford
1878	July 30	60	**Lake Megantic**	Beaver Line	Do.	Do.	Do.	Anticosta
1878	Sept. 28	61	**Herman Ludwig**	Steinman	Belgian	50	Never heard of	
1878	Sept.	62	**Yexford**	Swan and Co.	British	None	Foundered	At sea
1878	Nov. 26	63	**Pomerania**	Hamburg-American Line	German	50	Collision	Off Dover
1878	Dec. 4	64	**Bayard**	Kay and Co.	British	None	Foundered	At sea
1878	Dec. 17	65	**Homer**	Glover and Co.	Do.	43	Never heard of	
1879	Jan. 11	66	**Zanzibar**		Do.	48	Do.	
1879	Feb. 18	67	**Surbiton**	Watts and Co.	Do.	33	Do.	
1879	March 19	68	**Bernicia**		Do.	45	Do.	
1879	July 15	69	**State of Virginia**	State Line	Do.	9	Stranded	Sable Island
1879	Dec. 2	70	**Borussia**	Dominion Line	Do.	165	Foundered	At sea
1880	Feb. 10	71	**Hindoo**	Wilson Line	Do.	6	Do.	Do.
1880	March 14	72	**Montana**	Guion Line	Do.	None	Wrecked	Anglesea
1880	Sept. 10	73	**Anglia**	Anchor Line	Do.	Do.	Collision	At sea
1880	Dec. 31	74	**Brazilian**	Chart. by Warren Line	Do.	Do.	Wrecked	Near Liverpool
1881	Jan. 8	75	**City of Limerick**	Ross	Do.	43	Never heard of	
1881	Jan. 22	76	**Titania**	Gribel and Co.	German	27	Do.	
1881	Feb. 7	77	**Bohemian**	Leyland Line	British	33	Wrecked	Near Crookhaven
1881	March 3	78	**Drumduff**		Do.	1	Foundered	At sea
1881	April 16	79	**Beleine**		Do.	None	Do.	Do.
1881	May 29	80	**Macedonia**	Anchor Line	Do.	Do.	Stranded	Mull of Kintyre

TABLE No. 7—*continued.*

Year.	Month.	No.	Name of vessel.	Owners.	Nationality.	No. of lives lost.	How lost.	Where.
1881	Nov. 13	81	**City of London**	Ross	British	41	Never heard of	
1881	Dec. 1	82	**Hurworth**	Inveson and Co.	Do.	None	Foundered	At sea
1881	Dec. 3	83	**Bath City**	Bristol City Line	Do.	11	Do.	Do.
1881	Dec. 30	84	**Moravian**	Allan Line	Do.	None	Wrecked	Nova Scotia
1882	October	85	**Herder**	Hamburg-American Line	German	Do.	Do.	Newfoundland
1883	Jan. 3	86	**Straits of Dover**		British	27	Never heard of	
1883	Jan. 7	87	**City of Brussels**	Inman	Do.	10	Collision	Mouth of Mersey
1883	Jan. 19	88	**Cimbria**	Hamburg-American Line	German	389	Do.	North Sea
1883	Feb. 5	89	**Notting Hill**	Twin Screw Line	British	None	Coll. with iceberg	
1883	Feb. 15	90	**Glamorgan**	South Wales	Do.	7	Foundered	At sea
1883	Feb. 23	91	**Gloucester City**	Bristol City Line	Do.	None	Coll. with iceberg	
1884	April 3	92	**Daniel Steinman**	Red Cross Line	Belgian	116	Wrecked	Halifax
1884	April 18	93	**State of Florida**	State Line	British	108	Collision	At sea
1884	May 3	94	**Romano**	Wilson Line	Do.	None	Do.	Do.
1884	May 15	95	**Illyrian**	Leyland Line	Do.	Do.	Stranded	South coast of Ireland
1884	Dec. 24	96	**Coniston**		Do.	27	Never heard of	
1885	Jan. 20	97	**Fernwood**	Milburn	Do.	25	Do.	
1885	Jan. 20	98	**Preston**		Do.	29	Do.	
1885	Jan. 24	99	**Clandon**	Milburn	Do.	27	Do.	
1885	Jan. 25	100	**Benwell Tower**		Do.	2	Foundered	At sea
1885	Feb. 15	101	**Humber**	Wilson	Do.	56	Never heard of	
1885	June 14	102	**Lake Manitoba**	Beaver Line	Do.	None	Stranded	Miquelan Island
1885	Sept. 2	103	**Hanoverian**	Allan Line	Do.	Do.	Wrecked	Newfoundland
1885	Nov. 21	104	**Iberian**	Leyland Line	Do.	Do.	Stranded	South coast of Ireland
1886	March 1	105	**Missouri**	Warren Line	Do.	Do.	Do.	Welsh coast
1886	March 11	106	**Oregon**	Cunard Line	Do.	Do.	Collision	Fire Island
1886	June 30	107	**Lake Champlain**	Beaver Line	Do.	Do.	Stranded	Co. Antrim
1886	Sept. 28	108	**Suffolk**	Hooper, Murrell, and Williams	Do.	Do.	Do.	Near Lizard

TABLE No. 7—*continued.*

Year.	Month.	No.	Name of vessel.	Owners.	Nationality.	No. of lives lost.	How lost.	Where.
1887	Jan. 14	109	Celtic Monarch	Monarch Line	British	None	Foundered	Off coast of Ireland
1887	Aug. 12	110	City of Montreal	Inman Line	Do.	Do.	Burned	At sea
1887	Nov. 19	111	W. A. Scholten	Dutch Line	Dutch	130	Collision	English Channel
1887	Dec. 23	112	Newcastle City	Furness Line	British	None	Foundered	At sea
1888	Aug. 14	113	Geiser	Thingvalla Line	Danish	119	Collision	Off Sable Island
1889	April 6	114	Danmark	Do.	Do.	None	Foundered	At sea
1889	May 22	115	Cynthia	Donaldson Line	British	8	Collision	River St. Lawrence
1889	Oct. 27	116	Queensmore	Johnston Line	Do.	None	Burned	At sea
1889	Dec. 31	117	Erin	National Line	Do.	72	Never heard of	
1890	July 19	118	Egypt	Do.	Do.	None	Burned	At sea
1890	Nov. 26	119	Thanemore	Johnston Line	Do.	43	Never heard of	
1891	Feb. 22	120	Iowa	Warren Line	Do.	None	Coll. with iceberg	
1891	March 17	121	Utopia	Anchor Line	Do.	566	Collision	Gibraltar Bay
1891	December	122	Abyssinia	Guion Line	Do.	None	Burned	At sea
1892	Jan. 31	123	Eider	Norddeutscher	German	Do.	Stranded	Isle of Wight
1892	July 1	124	City of Chicago	Inman Line	British	Do.	Do.	South coast of Ireland
1893	Feb. 11	125	Naronic	Oceanic S. N. Co.	Do.	74	Never heard of	

Total number of lives lost through steamship disasters . . 6923
Estimated loss through various causes 600

Total number of lives lost . . . . . . 7523 from 1840 to 1893.

NOTE.—Dates given for vessels never heard of are dates of sailing from ports.

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"For a single passage to America the **Etruria**, with 547 cabin passengers, and a crew of 287 persons on board, carries the following quantities of provisions—12,550 lbs. fresh beef, 760 lbs. corned beef, 5320 lbs. mutton, 850 lbs. lamb, 350 lbs. veal, 350 lbs. pork, 2000 lbs. fresh fish, 600 fowls, 300 chickens, 100 ducks, 50 geese, 80 turkeys, 200 brace grouse, 15 tons potatoes, 30 hampers of vegetables, 220 quarts ice cream, 1000 quarts of milk, and 11,500 eggs (or at the rate of one egg per minute from the time the ship sails from Liverpool until her arrival in New York).

"The quantities of wines, spirits, beer, etc., put on board for consumption on the round voyage, comprise 1100 bottles champagne, 850 bottles claret, 6000 bottles ale, 2500 bottles porter, 4500 bottles mineral waters, 650 bottles various spirits.

"Crockery is broken very extensively, being at the rate of 900 plates, 280 cups, 438 saucers, 1213 tumblers, 200 wine-glasses, 27 decanters, and 63 water-bottles in a single voyage.

"As regards the consumption on board the whole Cunard fleet for one year, the figures seem almost fabulous—4656 sheep, 1800 lambs, 2474 oxen are consumed—an array of

flocks and herds, surpassing in extent the possessions of many a pastoral patriarch of ancient times—besides 24,075 fowls, 4230 ducks, 2200 turkeys, 2200 geese, 53 tons of ham, 20 tons bacon, 15 tons cheese, and 831,603 eggs.

"Other articles are in extensive demand, and in the course of a year there is consumed—one ton and a half of mustard, one ton and three-quarters of pepper, 7216 bottles pickles, 800 tins sardines, 33 tons salt cod and ling, 4192 four-lb. jars of jam, 15 tons marmalade, 22 tons raisins, currants, and figs, 18 tons split peas, 15 tons pearl barley, 17 tons rice, 34 tons oatmeal, 460 tons flour, 23 tons biscuits, 33 tons salt, 48,902 loaves of bread, 8 lbs. each.

"The Cunard passengers annually drink and smoke to the following extent—8030 bottles and 17,613 half-bottles champagne, 13,941 bottles and 7310 half-bottles claret, 9200 bottles other wines, 489,344 bottles ale and porter, 174,921 bottles mineral waters, 344,000 bottles spirits; 34,360 lbs. tobacco, 63,340 cigars, and 56,875 cigarettes.

"The heaviest item in the annual consumption of the Company is of course coal, of which 356,764 tons are burnt—nearly equal to 1000 tons for every day in the year.

"This quantity of coal, if built as a wall four feet high and one foot thick, would reach from Land's End to John o' Groat's House.

"With regard to the aggregate employment of labour by the Cunard Company, it includes 34 captains, 146 officers, 628 engineers, boiler-makers, and carpenters, 665 seamen, 916 firemen, 900 stewards, 62 stewardesses, 42 women to keep the upholstery and linen in order, with 1100 men of a shore gang, or about 4506 people to run the ships, which traverse yearly a distance equal to five times that between the earth and the moon!"

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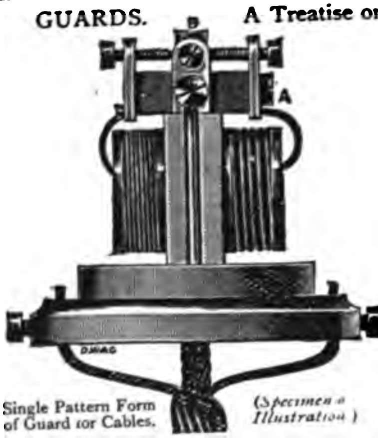

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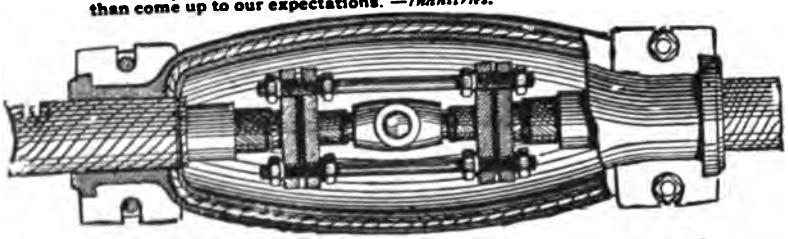

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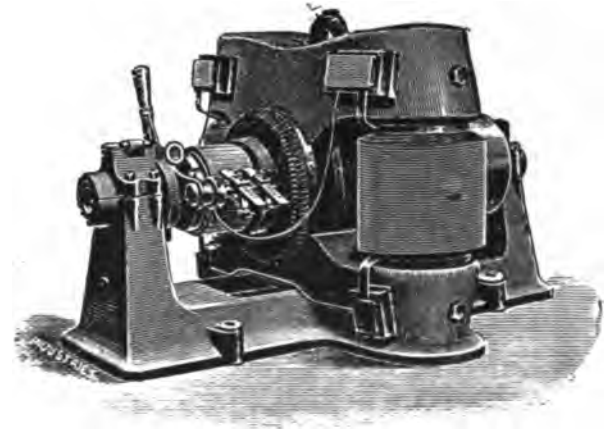

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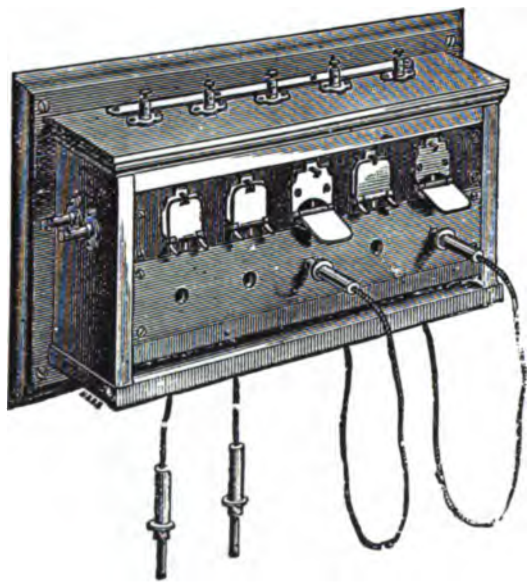

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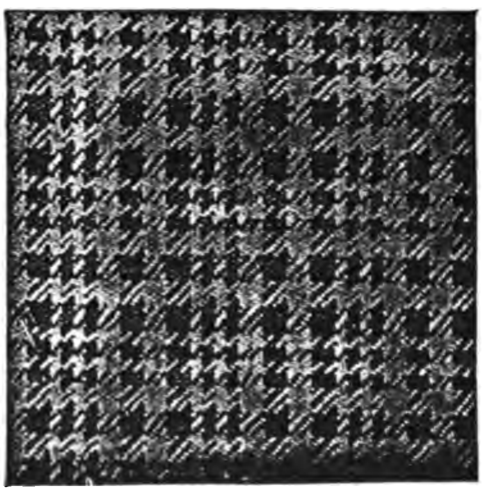

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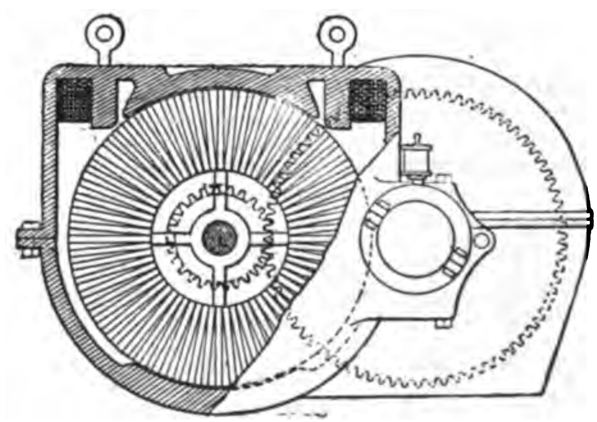

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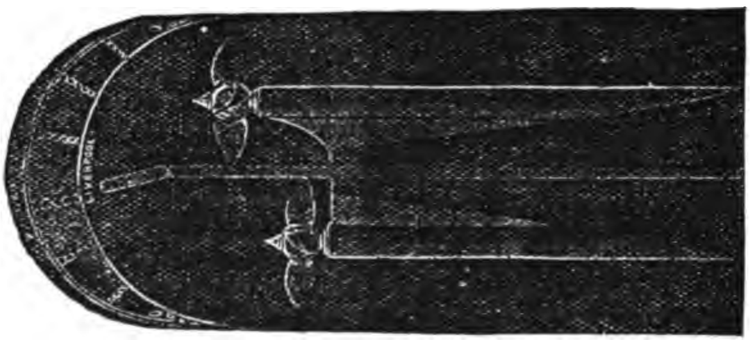

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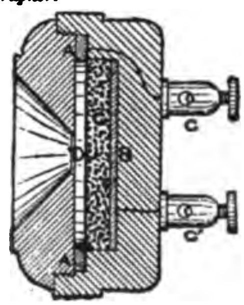

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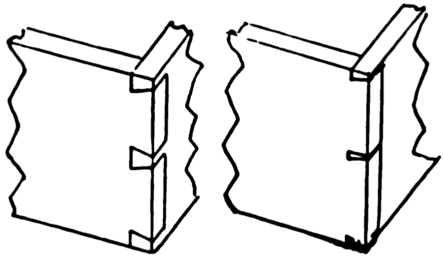

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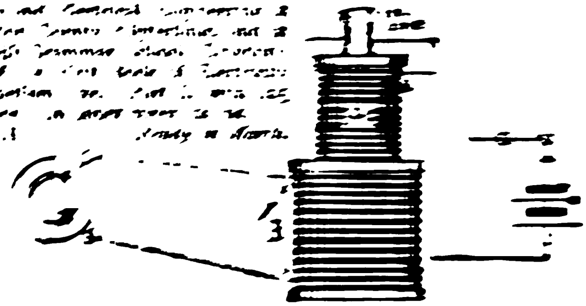

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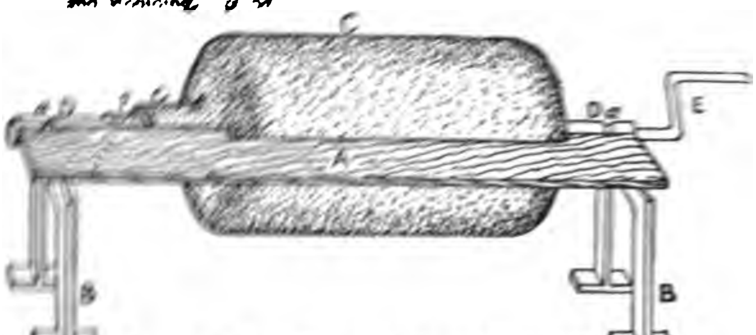

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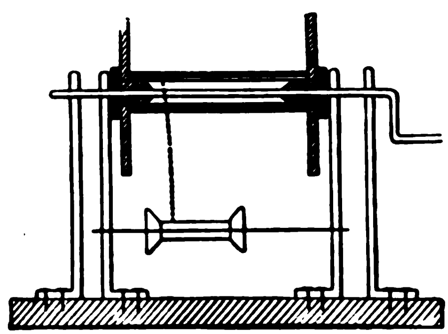

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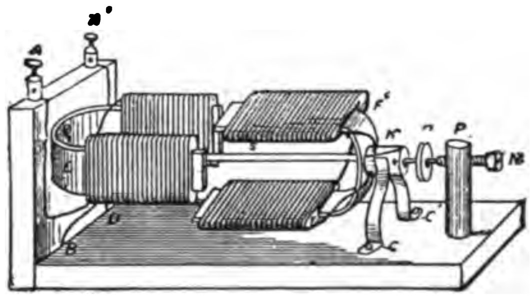

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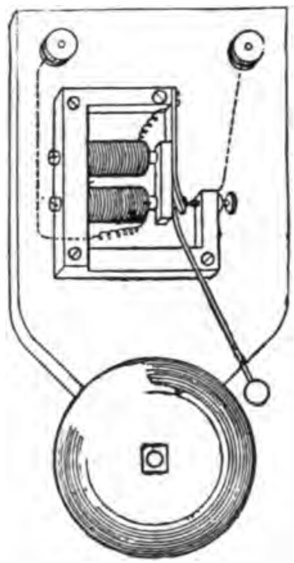

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